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PLANNING SCHOOLS FOR USE OF AUDIO-VISUAL MATERIALS. NO. 1--CLASSROOMS, 3RD EDITION.

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Intended to inform school board administrators and teachers of the current (1958) thinking on audio-visual instruction for use in planning new buildings, purchasing equipment, and planning instruction. Attention is given the problem of overcoming obstacles to the incorporation of audio-visual materials into the curriculum. Discussion includes--(1) space needs of classrooms with reference to the needs of audio-visual material, storage, project, and display areas, (2) equipment and methods for the control of light, sound, and aid, (3) wiring, outlets, projection stands, screens, and speakers required for operation of audio-visual equipment, and (4) a detailed review of requirements for operation of in-school television. A bibliography and a list of equipment manufacturers is included. (JT)

PLANNING SCHOOLS FOR USE OF AUDIO-VISUAL MATERIALS

1

THIRD EDITION

CLASSROOMS

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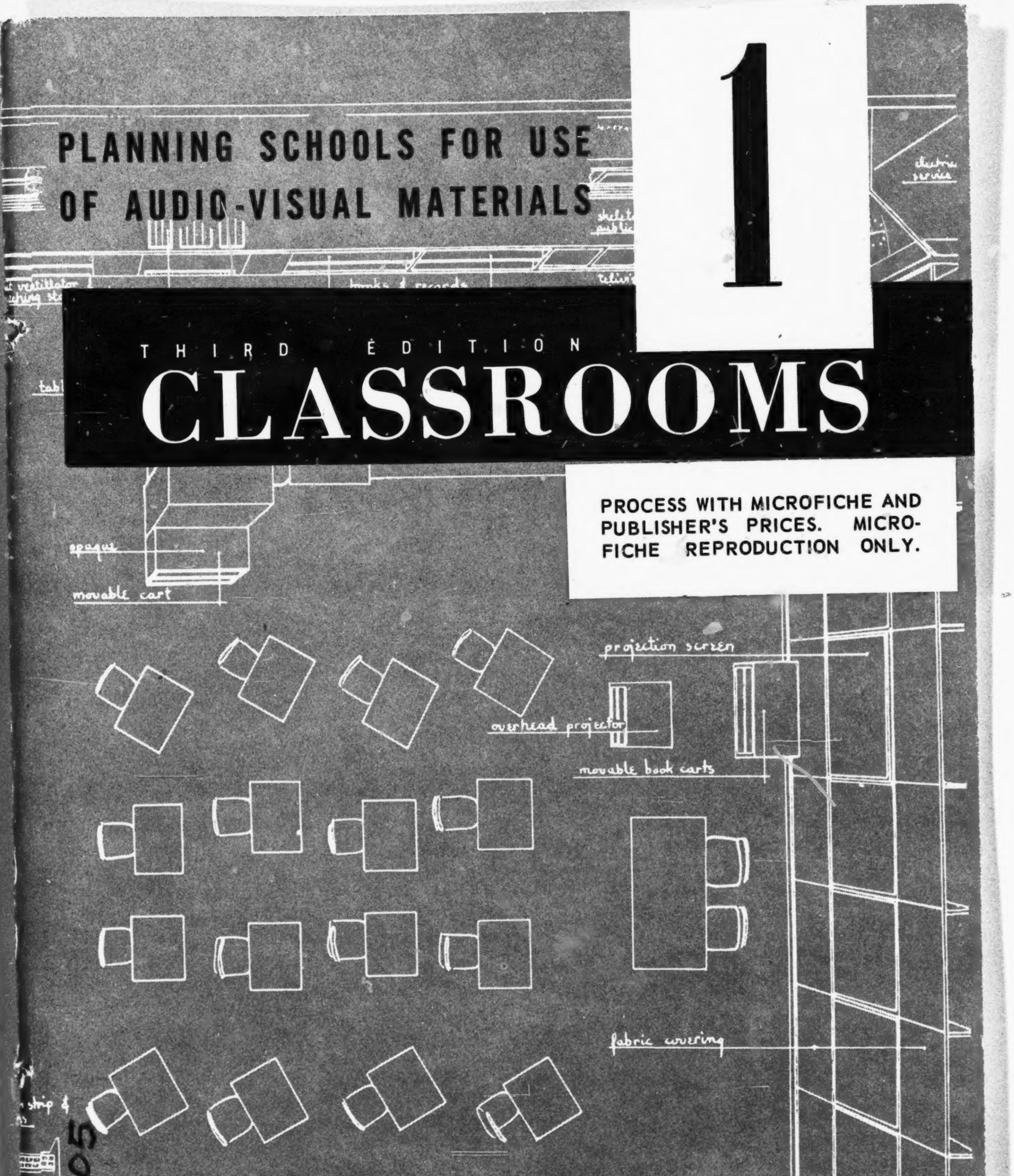
electric service
shelf public
television
books & records
ventilator
teaching st
table
opaque
movable cart
projection screen
overhead projector
movable book carts
fabric covering
strip &

Drawing prepared by
EGGERS & HIGGINS ARCHITECTS

Department of Audio-Visual Instruction of the National Education Association

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CHALLENGE

"It is likely that no area of a new school building will have as many varied and changing demands placed upon it in the next 5 to 20 years as will the basic classroom itself. It is probably true that no other single area of new building receives so little detailed attention from planners or is so poorly adapted to changing trends in education."

- Audio-visual techniques may be looked upon as symbolic of what is new and forward looking in school programs.
- For modern instructional procedures each classroom should have much more highly adaptable classroom floor space.
- Space is an essential tool of improved classroom procedures. If this space is too small, it is a poor, inefficient tool.
- Each classroom should be planned to permit as nearly as possible a 360° orientation to the instructional activities.
- Space should be set aside as the professional "office" and counseling room of the teacher.
- It is essential that storage space be provided within the classroom.
- We should be concerned with such light factors as glare and contrast as well as quantity of light.
- Light control is one of the most important problems facing school planners.
- Consideration of adequate light control at the time of the original planning can greatly affect cost and efficiency.
- Increased pupil activity, as well as the growing audio-visual program, has pointed up the need for attention to the sound-treating of all classrooms and other instructional areas.
- There must be electrical outlets in **all** areas of **all** classrooms.
- Every classroom should be provided with a projection screen.
- Through proper planning it should be possible to provide the potential of both open and closed-circuit television to any and all classrooms with little extra cost.

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PLANNING SCHOOLS FOR USE OF AUDIO-VISUAL MATERIALS

NO. 1
CLASSROOMS

JULY 1952
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FOREWORD

The Department of Audio-Visual Instruction of the NEA is to be congratulated on the rewriting of "No. 1—Classrooms" at this particular time. Indeed, the materials published herein constitute not a reprint of the first edition, but in fact a thorough rewriting, based on the newest research and insights relative to audio-visual instruction in the schools. In fact, new horizons are projected which—if taken into consideration by school board, administrators, and teachers when projecting new school buildings, purchasing equipment, and planning instruction—will speed up learning to an amazing degree.

The booklet is a gold mine of suggestions as to how obstacles to ready use of the many kinds of audio-visual materials now available can be overcome.

Backed by research and the imagination of efficient teaching, children housed in environments such as proposed in "No. 1—Classrooms" should outstrip the intellectual development of former generations.

This booklet fits in admirably with the chapter on objectives of the recent administrators' publication, "You and AASA." Goal VI is directed toward "Improving the Classroom Facilities, Equipment, and Instructional Supplies Essential to Good Teaching."

FINIS E. ENGLEMAN
Executive Secretary
American Association of
School Administrators

THE WHY—of Classroom Planning

It is very likely that no area of a new school building will have as many varied and changing demands placed upon it in the next 5 to 20 years as will the "basic" classroom. Unfortunately, it is also probably true that no other single area of new buildings receives so little detailed attention from planners or is so poorly adapted in general to changing times in education.

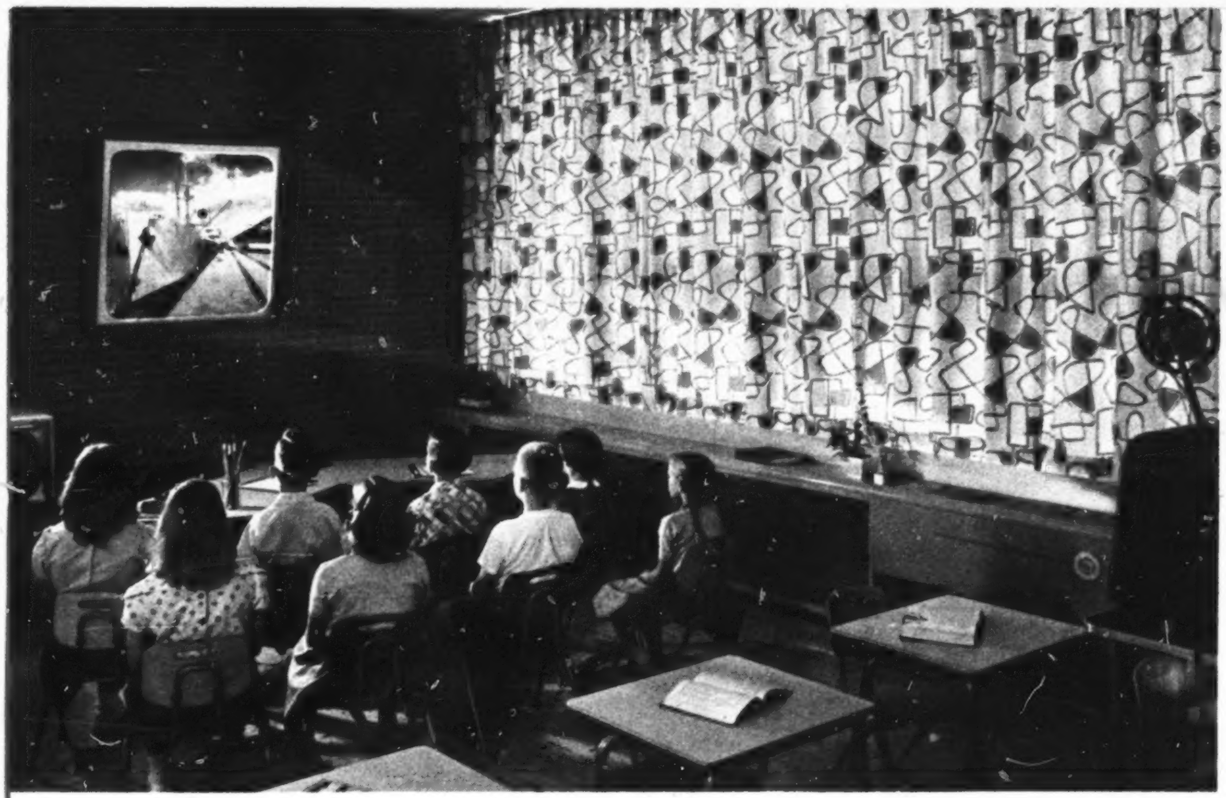
Our way of life and our educational program are vastly different today from life and schooling a few generations back. Education today is complex and uses many tools unheard of a few years ago. We have learned a great deal in recent years about how to improve the school learning environment for more effective learning. In our schools we are changing from a textbook dominated curriculum to a plan and program of schooling which is based upon what is known to be best for good total behavior development. It is important that this progress be reflected in the schools we build for modern communities.

Of course, a youth's learning goes on wherever he goes. He cannot escape the everyday learning experiences, good and bad, which go on every moment he is awake. However, in the modern community the workshop of a youth's *directed learning* program is the classroom. Here is the place where, under skilled teacher guidance, young Americans work day by day at the big job of learning how to learn, and where in a wholesome environment they practice the essential skills of living and working together. Here is the single place where a community may most effectively apply its resources for youth education.

A well-planned field trip is an effective tool of instruction.

San Diego City Schools

S.D. FIRE DEPT.



American Council on Education

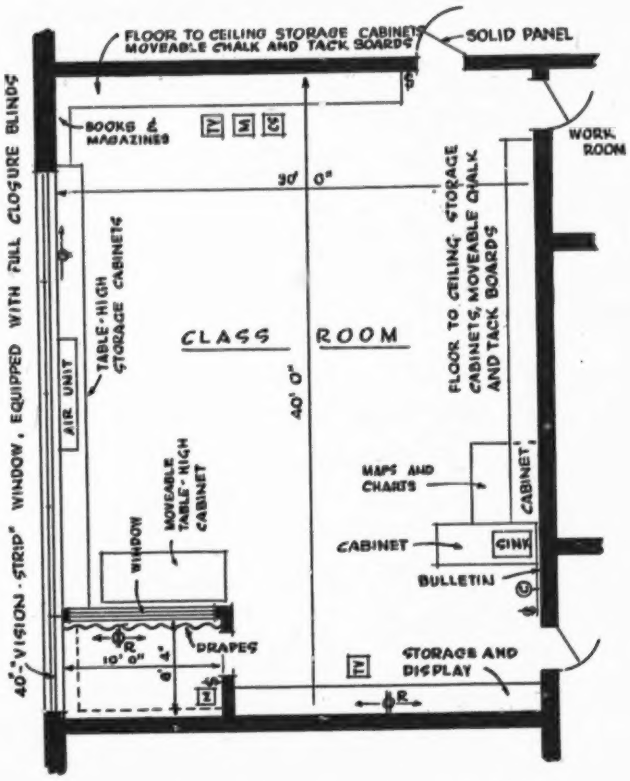
A modern classroom showing translucent window shades and opaque drapes for light control, flexible seating, display and storage facilities.

The Self-Contained Classroom

To serve the purposes and procedures of modern education, classrooms must be provided in which there is adequate *space,* healthful *air* and *light,* proper *equipment,* and *instructional materials* and facilities for a great variety of activities. When there are proper school facilities which permit the application of the best methods and of the most efficient programming, the young learner does much of his school work in well-equipped classrooms under the personal guidance of skilled teachers. In the past, particularly in the upper grades and high schools, much of the "study" and other "learning" activity went on outside the classroom with the misguidance of well-meaning but frequently unskilled and already overburdened librarians, or study-hall teachers, or busy parents.

What is the modern, more efficient classroom? What characterizes these laboratories for learning in which teachers may do a more efficient and effective job, and in which youth may enjoy the advantages of the best know-how in education?

For the best application of what is known to be good educational practice, each modern school should have a number of "regular" classrooms sufficient to accommodate all its students in groups of probably not more than 25 or 30. These rooms should be in addition to those which are especially equipped as laboratories—special purpose areas such as language


FLOOR TO CEILING STORAGE CABINETS
MOVEABLE CHALK AND TACK BOARDS
SOLID PANEL
WORK ROOM
BOOKS & MAGAZINES
TV
M
CS
30' 0"
40" "VISION-STRIP" WINDOW, EQUIPPED WITH FULL CLOSURE BLINDS
TABLE-HIGH STORAGE CABINETS
AIR UNIT
CLASS ROOM
40' 0"
FLOOR TO CEILING STORAGE CABINETS, MOVEABLE CHALK AND TACK BOARDS
MAPS AND CHARTS
CABINET
CABINET
SINK
BULLETIN
MOVEABLE TABLE-HIGH CABINET
WINDOW
DRAPES
R
10' 0"
8' 4"
TV
STORAGE AND DISPLAY
R

Schematic drawing of a modern self-contained classroom.

LEGEND

TV TV Cable
M Microphone
CS Central Sound
C Clock
S Switch
↔ Electric Outlets (18" to 36" apart on all walls table high)

New York University

laboratories, large-group instruction rooms, or shops for special-skills development. The classroom should first of all have ample efficient space.

Space

As with any other instructional equipment, if schoolroom space is not big enough to do the job, it is poor equipment. A classroom should have:

1. Approximately 1200 square feet of usable, adaptable classroom floor space to allow for all types of learning activities and equipment and enough room for healthful viewing of projected pictures.

2. Approximately 100 square feet of floor space immediately adjacent to, but detached from the classroom proper for use as a teacher's study and lesson preparation room and as a pupil-teacher-parent conference room.

3. Approximately 100 square feet of student "special-work" space for individual student and group work on construction of an experimental nature with instructional materials and projects at all grade levels.

4. Adequate storage spaces for instructional materials and student work.

Healthful Environment

Of course every effort should be exerted to have such a room provide a healthful environment. The following features are important:

5. Facilities for maintaining from 25 to 60 foot-candles (depending upon eye-tasks to be performed and upon the contrast ratios prevailing

between eye-task areas and peripheral vision areas) of shadow-free, glare-free light from electrical sources at all reading and working areas (to provide ratios of 1 to 3 foot lamberts for immediate tasks and 1 to 10 for general immediate environment).

6. Facilities for reducing light in varying degrees to as low as 1/10 foot-candle on projection screens for certain types of picture projections.
7. Means of heating and cooling and ventilating without noise or drafts under all conditions of use.
8. Facilities and structure which screen out distracting outside noises and reduce reverberation of sound from within the room.
9. Decorations and furnishings in pleasant, light color tones.

Learning-Aid Facilities

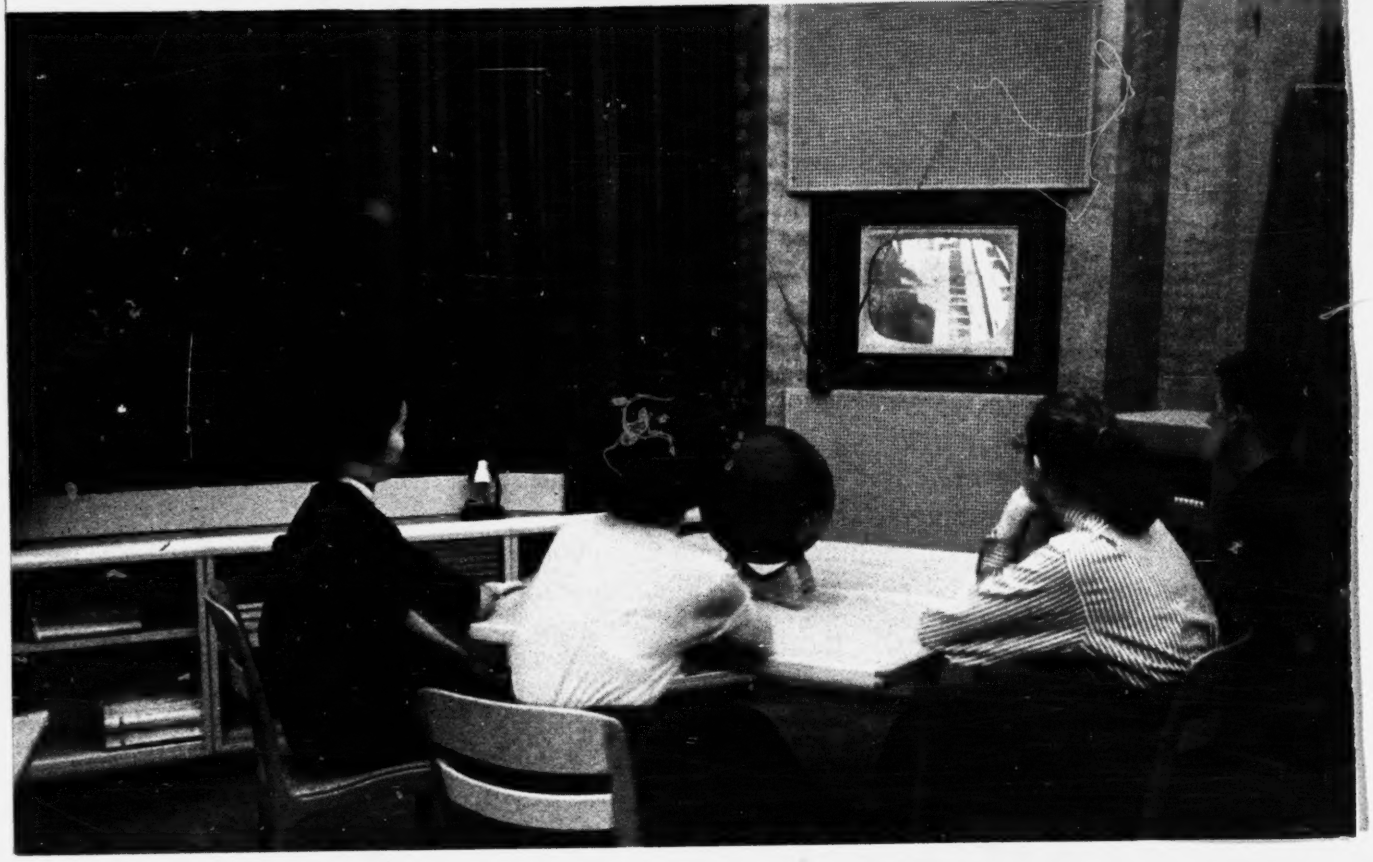
The modern classroom should have the learning-aid facilities needed for the jobs to be accomplished. Plans should include:

10. Wiring for the convenient use of modern classroom equipment, including many electrical outlets and coaxial cables for broadcast and closed-circuit television.
11. Classroom sink with hot and cold running water.
12. Functional equipment for projection, radio, television, recording and playback, as well as books, maps, globes, chalkboards, display surfaces, and learning-resources files.
13. Flexible, adaptable, healthful furniture.

These are the demands good education makes of a schoolroom.

The efficient classroom is adaptable to small group use of audio-visual equipment.

New York University



THE WHAT—Facilitating the Audio-Visual Program

Without de-emphasizing any part of the above list, let us look more closely at certain of these demands which have developed particular importance because of the widespread use of audio-visual materials in the school program.

While there are other indices of functional obsolescence in a school building, a school plant in the mid-twentieth century is to a degree obsolete if it is not properly equipped for efficient day-by-day use of audio-visual materials of all types in every classroom. This criterion, while meeting with little disagreement on the philosophical level, is very often completely neglected in the preparation of new building designs.

Few will deny, for example, the important values of projected pictures in the instructional programs of our schools today. Yet every day of the year professional educators, architects, and school planning committees are approving the expenditure of millions of school-building dollars for new classrooms in which projected pictures cannot be used effectively for instructional purposes. Furthermore, experience has shown that within a very short time after construction, additional and relatively high costs will be paid to adapt these same rooms for use of motion pictures, opaque projectors, television receivers, and other visual instruction equipment.

Audio-visual ways of teaching and learning are here to stay. Hence it is an expensive oversight to neglect this fact in the planning of new school plants. Negligence in providing for audio-visual facilities is a sign of a basic defect in planning in a community's school building program.

Audio-visual techniques may be looked upon as symbolic of what is new and forward-looking in school programs. They are a basic, integral part of good teaching, a part of an ever-increasing body of knowledge about how people learn, and about how teachers can assist pupils to do a better job of learning in school. School plants in which adequate provision for audio-visual instruction has not been made are not likely to be suitable for other improved instructional procedures of today and tomorrow.

Even at best our new buildings will, to some degree, be out of date the day they are opened for use. The first challenge to school plant planners is to avoid any immediate functional obsolescence which can be foretold from what we know *now* of good educational procedures. A second challenge reflects our responsibilities to future generations and to future progress: if we believe in progress we will strive, through the creation of flexible and adaptable building spaces, to delay any restrictions our present ideas of a school curriculum might impose on improved educational programs of the future.

SPACE

The Classroom

For classrooms of the past, where simple recitation and lecture comprised the major method of classroom instruction, 700 to 900 square feet of floor space may have been adequate. For many of the audio-visual centered activities as well as other modern instructional procedures today, each classroom should really have a great deal more highly adaptable classroom floor space. Space–"room to operate"–is an essential tool for improved classroom procedures. If this space is too small, it is an inefficient tool. For common present-day maximum class sizes (i.e. 30 students–and it is believed that we must plan for groups of this size), an average of 40 square feet per pupil must be provided for his chair, his desk, his chalkboard work, his reference shelf work, his part of "group work" in the classroom, and all other possible activities in which he engages in the room. It means his share of room space for temporary storage of "projects" and study materials, for a record player, a tape recorder, a radio, a television set, a slide viewer, a globe, an exhibit and other equipment. It means his share of space for classroom dramatizations, oral reporting, guest speakers, and other such activities. It also means uncrowded space for him to study or listen without the distraction of others in too close proximity.

Uncrowded space for group work and other activities which do not involve the total class.

Vanderburgh, Indiana Co. Schools

Small Rooms Restrict Classroom Procedures, Including A-V

It is probable that no *basic* classroom in the school built today should be a small classroom.[1] Small rooms are not adaptable to good use of *all* modern procedures, such as viewing films, even with class groups of small size. Nor do these rooms of traditional size permit a wide variety of activities. Smaller sections of classes may use the largest rooms with efficiency, but large groups cannot similarly make good use of relatively small spaces. In this connection it is poor planning to construct a building to fit only present day curriculums and class schedules. No present-day curriculum demands or class schedules should be permitted to determine, through room size or arrangement, the curriculum or schedule of the future.

San Diego City Schools

A classroom which is too small.

Design Affects Efficiency of Use

The structure, design, fenestration, and equipment of each classroom should be so planned as to permit as nearly as possible a 360° orientation to the instructional activities in the room. A room in which students must face one or even two directions at all times if they wish to avoid glare is an inefficient room. This is particularly important when a wide variety of audio-visual materials and equipment is employed by the teacher. Similarly all walls should be as much as possible "instructional" walls, equipped and lighted for instructional purposes. Yet maximum fenestration, such as clerestory windows and the like makes such full use of the room difficult. On the other hand, minimum fenestration (possibly a 40″ vision strip on one wall), together with thoroughly adequate electrical lighting, makes for more efficient use of the room space. However, in construction calling for maximum use of daylighting, the plain-glass fenestration may be supplemented by use of one of the new solar-selecting glass bricks designed to minimize surface brightness.

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[1] With the rapid advance in the use of television for areas of the curriculum which meet common needs of larger segments of a school's population, areas even larger than our largest basic classroom may need to be adapted for television instruction procedures.

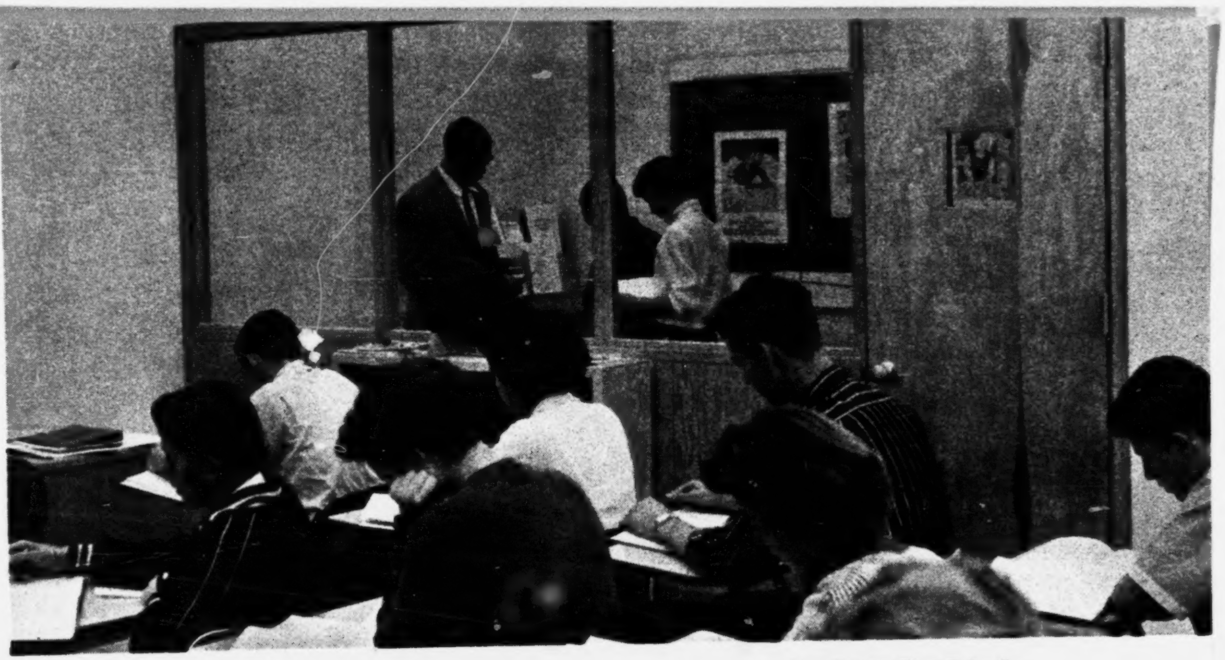
Classroom equipped with glass brick to control high sky glare and drapes for use when projecting picture or viewing telecasts.

Milwaukee Board of School Directors

Auxiliary Space

Approximately 100 square feet of space immediately adjacent to the classroom should be set aside as the professional "office" and counseling room of the teacher. Elementary and high school teachers are virtually the only professional people for whom professional office space is not commonly provided. This space should be so partitioned off from the classroom that within it pupil-teacher or parent-pupil-teacher conferences may be conducted in relative privacy. In addition to providing a place for study, record keeping, and consultation, this space should make it possible for teachers to review all types of instructional materials in preparation for their use in the classroom.

The usefulness of this teacher's space grows with the increased responsibility of the teacher for teacher-pupil relationships above and beyond "assignment, lecture, recitation" levels. Its necessity becomes more evident as teachers assume direct responsibility for large, continuous blocks of time with groups of students. Failure to make provisions for such a facility now—because at present it would be of only restricted use to



San Diego City Schools

Auxiliary space used as teacher-pupil-parent counseling room as well as the teacher's office.

some teachers—would surely place a serious handicap on teachers in the future. Even now the alert teacher is becoming increasingly critical of "working conditions." A recent survey indicates that a prospective teacher's selection of a position from among a number of possible job offers is conditioned to a degree by the teacher's judgment of the working conditions provided.

In addition to the teacher's office and counseling room, a space should be provided for those creative activities of small groups of students which might be distracting to the total class or which might require construction work and storage from day to day until completion. This is a space in which many of the pupil-made instructional materials may be prepared. This area, if jointly used by two adjoining classrooms, should occupy approximately 150-200 square feet of floor space.

Classroom space for "creative activities" of small groups of students.

New York University

Spokane City Schools

Flexible classroom storage provided by movable cabinets.

Classroom Storage Space

As the curriculum in this country moved beyond the single text for each subject, it become increasingly important that each classroom have storage for various kinds and amounts of instructional materials. Again such space in abundance is essential for classrooms where the more modern "core," or large-time block procedures are employed. Hence in the truly effective classroom, which is now used or which will be used in the future for many types of learning activities, it is essential that a great deal of storage space be provided. This space should accommodate maps, charts, pictures, specimens, and other materials as well as reference books, auxiliary texts, etc.

Adequate storage space in the classroom is required for such commonly used materials as flat pictures, charts, posters, maps, filmstrips, construction materials, and slides. Such facilities as the following should be considered:

1. Legal size file cabinets
2. Chart cabinet in which pictures, posters, and charts up to 36 by 36 inches can be stored flat
3. Cabinet with drawers of various sizes to hold miscellaneous supplies and materials
4. Storage space in wall areas (Note: Maximum adaptability to future programs may be assured by making cabinets movable.)

Although audio-visual equipment circulated among classrooms will usually be stored in the school audio-visual center, storage facilities that can be locked should be provided for equipment that is temporarily or permanently assigned to a room. Building plans should anticipate the time when much of the so-called AV equipment, such as projectors, receivers, tape recorders, and the like will remain in the classroom as a regular part of the *permanent* equipment.

Vanderburgh, Indiana Co. Schools

A room with ample project area.

Project Areas

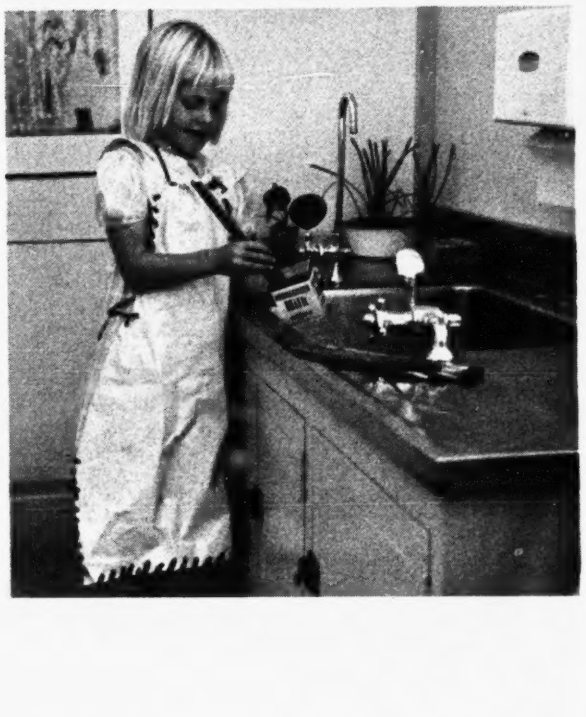
Modern educational practices call for learning experiences requiring flexibility of seating arrangements and for small group activities. The term "project area" is frequently used to refer to the space needed for these small work groups.

There should be ample space at the side or rear of single room units to permit individuals and small groups to use various audio-visual materials without unduly distracting other work groups in the room. Such group-work areas within the classroom proper are in addition to the small project rooms separate from, but immediately adjacent to, the classroom.

Both types of project area, whether in the general classroom space or separate from it, should be provided with at least two electrical outlets. The project space should be provided with a sink or water basin not less than 24 inches by 12 inches and 9 inches deep, equipped with low pressure, quiet-running faucets for both hot and cold water, and with a positive overflow control. The sink unit should be equipped with an approved drinking fountain device.

"No-splash" classroom sink with quiet-running faucets.

San Diego City Schools



A small projection screen, 40 by 40 inches, in addition to the regular classroom screen, should be provided for such areas.

Display Facilities

Classrooms should be supplied with adequate vertical and horizontal display space. It is difficult to define what is sufficient since the needs depend on the type of teaching and the nature of the learning activities which will take place in the room. For this reason it is advisable to use flexible installations that can be changed readily to increase or decrease the area of display facilities, or to use dual purpose installations (e.g. chalkboard on one side, "tackboard" on other side of reversible panels.)

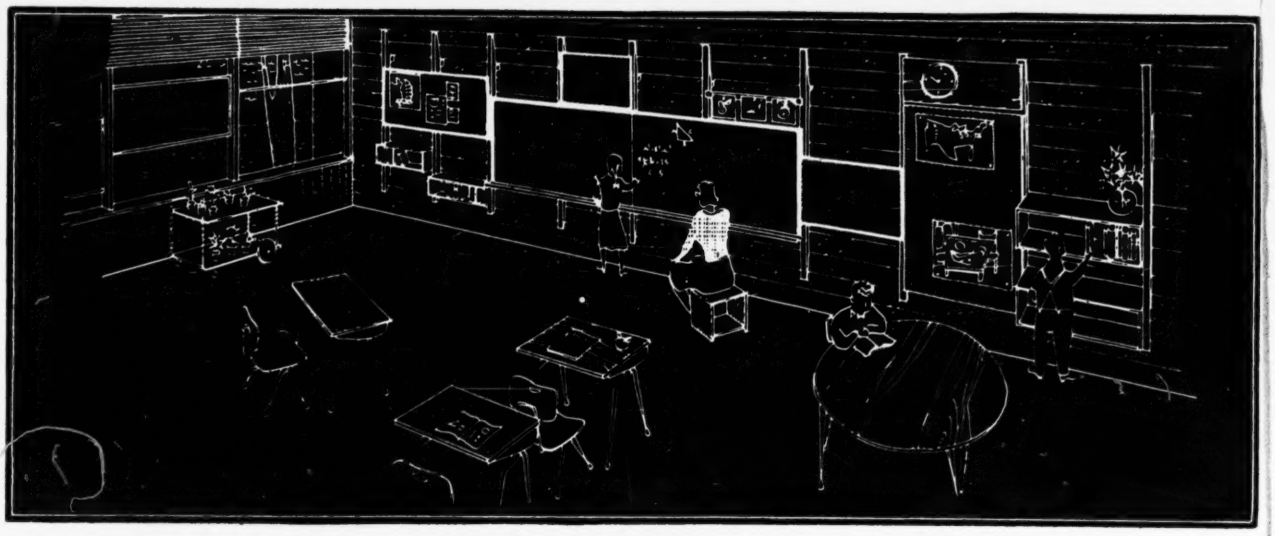
Vertical display facilities, such as chalkboards and tackboards, should be installed at pupil eye level and should be well lighted. In planning for the installation of chalkboard, careful attention should be paid to the color and reflection qualities of the surfaces to assure the best possible "seeing" conditions. Display boards should have light colored surfaces.

Some methods of providing flexibility in the amount of vertical display facilities are the use of (a) reversible chalkboards and bulletin boards, (b) "swinging" boards which consist of a number of wings or leaves which can be turned at will, (c) counter-balanced chalk and bulletin boards that can be raised to expose additional chalk or bulletin board areas, (d) pegboard panels equipped with various hooks and clamps and other devices for mounting displays and exhibits, (e) vertical stanchions equipped for mounting a wide variety of two and three dimensional exhibits, (f) display rails, attached above the chalkboard with adjustable, movable hooks to adapt to various sizes and types of display boards, and (g) one or more panels of chalkboard surface on magnetic (steel) backing for use with magnetized displays.

Horizontal display areas should provide for the exhibition of objects, models, and exhibits. Here again dual purpose fixtures can be utilized. The

A blank wall may be converted to an "instructional" wall by installation of flexible, vertical display equipment.

Moduwall, Inc.



most common types are (a) those that pull out from a recess in the walls, and (b) hinged shelves that can be raised and locked into position. A horizontal display surface can also serve as a cover for a storage bin, drawer space or shelving.

Storage chests for posters, charts or maps, when mounted on gliders and fitted with durable table tops, become movable display space, room dividers, and work tables. Where storage closets or cabinets extend into the classroom or workroom area the protruding walls of these closets can be used for additional vertical display boards.

Any door sills should be flush with the floor so that equipment carried on wheeled carts may be transported easily from room to room.

HEALTHFUL ENVIRONMENT

The Light Problem

As has been pointed out, facilities should be provided for maintaining from 25 to 60 foot-candles of shadow-free, glare-free light from electrical sources at all reading and working areas, to provide ratios of 1 to 3 foot lamberts for immediate tasks and 1 to 10 for general immediate environment. For some time now we have realized that a very large share of the work done in a school involves intensive use of the eyes. We have gone after "enough light" for these visual, or seeing tasks. Recently we have been concerned with such light factors as glare and contrast as well as quantity of light. To meet our quantity standards we began many years ago to increase the percentage of wall and ceiling areas devoted to natural light entrances. This, prior to the development of efficient electrical light sources for classrooms, seemed to be the "economical" thing to do, even though we were aware that the use of natural light sources for our main light supply resulted in great variations in the amount and quality of light on the many surfaces of the classroom. To meet the "quality standards" concerned with glare, shadow, etc., we have attempted to establish "controls."

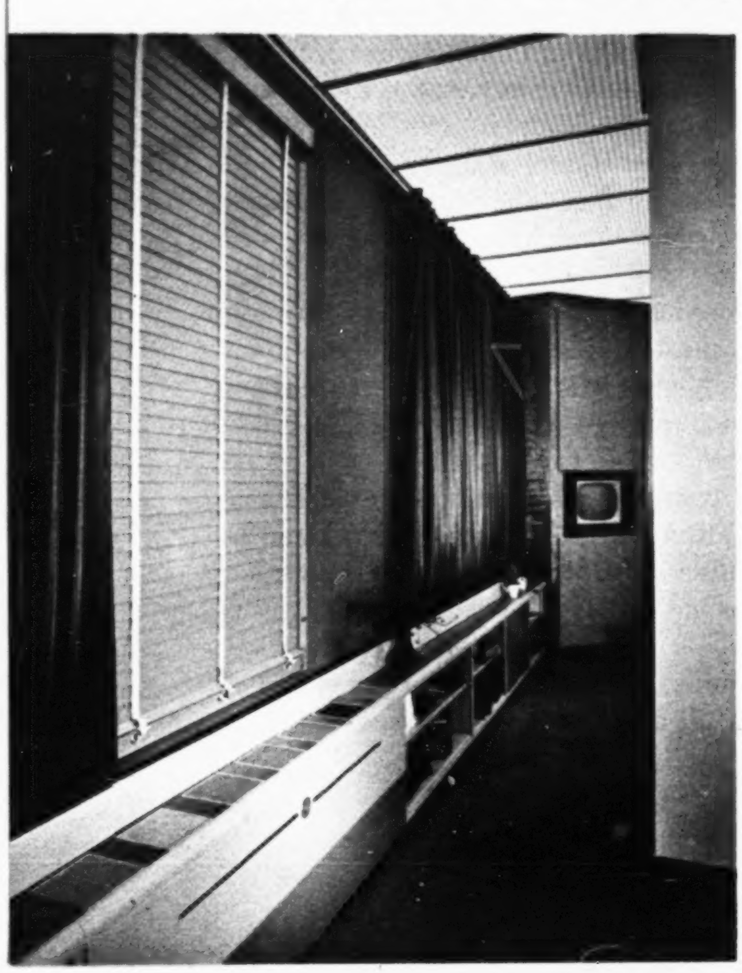
More recently we have discovered that to meet both quantity and quality standards, building planners must supplement even the maximum natural sources with a consistent supply of light from electrical sources and must provide wall, floor, and furniture surfaces which have proper reflection values.

Through careful planning and complete application of all of those lighting developments, plus careful attention to light contrasts created by coloring and surface treatment of walls and furniture, the modern architect is able to create good light conditions in the classrooms and laboratories of our new school buildings.

Herein "lies the rub." School planners and teachers alike demand good shadow-free and glare-free light for all classrooms. Modern teachers demand good light plus the degree of light control which will permit efficient use of projectors of all types. School planners frequently agree in principle with the teacher but point to the increased cost of meeting both demands.

In this connection it is interesting to note that some modern planners are using a very simple way to satisfy both the demand for good light and the need for more complete light control, at an overall saving in costs. It has become quite clear that the demands of the modern instructional program may be met by constructing classrooms which utilize natural daylight and light from electrical sources with maximum efficiency. Large "picture-window" walls, for example, which in themselves are relatively expensive and which frequently require costly structural adaptations, do present a large source of natural light, but in making this light available present not only undesirable sky, snow, and ground glare, but also the visual distraction of out-of-school activities. Consequently, to these sources must be applied light control devices which reduce in turn their classroom-light producing efficiency. Similarly, clerestory windows and light sources in the ceiling, while raising the potential of natural light in the classroom, are relatively costly and inefficient. Such installations normally require additional expenditure for building structure adaptation, for installation of light control devices, and for unusual maintenance costs.

Original costs, cost of complete light control, and maintenance cost may be materially reduced by providing for all of the ordinary classroom light demands from electrical sources, and by supplying only enough window space for the comfort of being able to look out of a window. The



A wall panel illustrating two commonly used methods of light control, drapes and full-closure Venetian blinds. It should be noted that normally one, not both methods of control would be applied to a window area.

Joseph W. Molitor

light from such reduced window areas may be easily controlled by relatively inexpensive installations of full-closure Venetian blinds, or decorative classroom drape materials, or both. Such de-emphasis of window areas in favor of more efficient lighting schemes also leads to reduced operating expenditures (i.e., less heat loss and less fuel consumption and less maintenance cost) and to more efficient use of classroom space. Then instruction becomes not only more nearly 360° oriented, but to a degree at least, the fourth wall becomes an "instructional wall."

The Amount of Light Control

Light control is one of the most important of the special problems facing school planners who are designing classrooms to fit the needs of modern education. At the present time light control facilities are a "must." No system has yet been devised which permits satisfactory day-to-day use of the several projected-picture mediums in the classroom without light control facilities in addition to those which control sun and high sky glare.[2]

To assure optimum use of all projected materials, the light reaching the classroom should be controlled so that the illumination in the room, particularly on the surface of the screen, does not exceed one-tenth foot-candle. The level of light permissible for any specific situation will, of course, vary depending on such factors as kinds of materials being projected, equipment used, picture size, and specific class needs such as note-taking. (1, 4)

It is recognized that, with modern, properly functioning projection equipment, *some* pictures may be viewed effectively when the light level in the room is higher than one-tenth foot-candle. This specification of minimum brightness does, however, recognize the necessity of achieving satisfactory light control for the use of color projections, for the use of such important classroom devices as the opaque projector and the micro-projector, for the comfortable viewing of pictures over a considerable period of time, and for good tonal quality in the projected picture.

The Committee on Non-Theatrical Equipment of the Society of Motion Picture Engineers makes the following comments on room darkening:

"Good tonal quality in the projected picture is impossible if the room in which it is being viewed is not adequately darkened. On the other hand, this does not mean that the room must be absolutely dark. Studies have indicated that a general room light of the order of one-tenth foot-candle is not harmful. This is a level of illumination under which it is difficult but not impossible to read ordinary newspaper type.

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[2] The Committee recognizes that considerable research is in process to develop screens which are optically more efficient. However, at the present time there is no new development on the market which eliminates the necessity for general light control in the classroom. So called "daylight" screens may be used successfully for projection from high-intensity projectors (not for opaque projectors or for most color transparencies) and for groups of limited size and seating arrangement. Such screens are in no sense an all-purpose classroom screen and do not eliminate the necessity of light control devices in the classroom.

Aside from making provisions for excluding light from the room until the general level of illumination is at least as low as is indicated above, it is particularly necessary to make sure that no narrow beams of light, especially sunlight, enter the room to produce bright spots on walls near the screen, or to strike other objects in the room to produce bright spots on walls near the screen, or to strike other objects in the room from which dazzling reflections will be thrown. For the comfort of the spectators the screen should be the brightest object in the room." (50:12-13)

The control of natural light entering the classroom, so that the illumination in the room may be reduced to a point where it does not exceed one-tenth foot-candle, will assure the satisfactory use of all types of projected materials and is therefore a basic requirement in classroom planning. However, there are other considerations in the matter of light control which a school should consider if optimum projection facilities are desired.

One of the most desirable of these additional facilities is the ability to provide at will controlled amounts of general low-level room illumination which will not fall directly on the projection screen. This provision enables the teacher to increase the light level in the classroom when certain types of materials are being projected. With materials such as slides of line-drawings, enough light can be permitted to enable pupils to take notes. Eyestrain, which may result when projected pictures are viewed over long periods of time in an excessively darkened room, can be effectively reduced with this low-level lighting.

Research on the illumination of projection screen surroundings has been carried on for a number of years by the Illumination Engineering Society. In view of our present knowledge, it seems desirable to be able to carry the amount of general illumination in the room during projection from one-tenth to one foot-candle. When one foot-candle of light is directed downward in a normal size classroom, probably about one-half foot-candle of non-image forming light will be falling on the projection screen. One foot-candle of downlighting on desks will permit the taking of simple notes. A system of general low-level lighting may also prove useful when the instructor employs "spot-lighting" to illuminate a class demonstration, a chalkboard presentation, or classroom dramatizations.

Because of the variable character of outdoor light admitted to the classroom at various times of the day, it is difficult to admit just the proper amount of overall illumination for the classroom during projection by the use of partially translucent material over the windows. The simplest and most desirable method of obtaining the proper amount of room illumination during projection is to use general low-level lighting from electrical sources.

This low-level lighting can be provided by one or two lighting fixtures installed in the ceiling toward the side of the room opposite the projection screen in such a manner that the light is directed downward and away from the screen. By varying the wattage of the bulbs used in such fixtures, considerable flexibility can be obtained as demanded in each classroom. It may be more practical thus to achieve the proper low-level lighting by the use of extra switches than by the use of dimmers.

The opaque projector is an important classroom device which requires proper light control for effective use.

Charles Beseler Co.

Methods of Control of Natural Light Sources

Numerous surveys have been conducted to collect data on methods of light control in common use and on the relative merits of these methods. The results of a number of surveys on methods of light control were studied by the Committee that assisted with the preparation of this handbook. The most common methods of light control of natural light sources were found to be these:

Drapes (opaque only; also a combination of translucent drapes for general glare control and opaque drapes for darkening.)
Opaque shades (blinds)
Full-closure Venetian blinds

It should be noted that consideration of adequate light control at the time of the original planning and construction of a building can greatly affect the cost and the efficiency of such installations.

Where the provision for light control necessary for full use of audio-visual procedures was overlooked in initial planning, in favor of the misconception that projected pictures will be viewed in a central "audio-visual" room, school boards have experienced the inevitable extra expense of going back and equipping classrooms for audio-visual purposes after the building was up and in use. The cost of light control facilities installed after building construction is considerably higher than when such installations are made at the time of construction. The inefficiency of attempting to schedule all viewing of projected materials necessary to modern instructional programs in a central viewing room is no longer doubted.

The generally accepted advantages and disadvantages of each of these three common methods of light control are here discussed briefly. In selecting a method or methods of light control to be used in any given situation, planners should consider these factors: (a) effectiveness for controlling light, (b) durability, (c) cost, (d) ease of installation, (e) ease and cost of maintenance.

Drapes—The result of surveys indicates widespread recommendation of drapes as an effective and economical method of light control, and the trend seems to be toward the use of opaque, fire-resistant, plastic drapes installed on tracks.

Literature in the field contains such descriptive names of drapes as roller-type drapes, pull-up accordion drapes, portable drapes, and pull drapes mounted on tracks. Drapes may be made of opaque cloth of many types or of opaque plastic.

The method of "drape" light control favored by most audio-visual directors at the present time is the use of pull drapes on permanently installed tracks. Among the advantages set forth for this method are:

1. They are highly efficient when properly installed.
2. They are easily operated.
3. They need not interfere with ventilation of classroom.
4. They may improve acoustics of classroom.
5. They are available in colors and may therefore be planned to add to the attractiveness of a room.

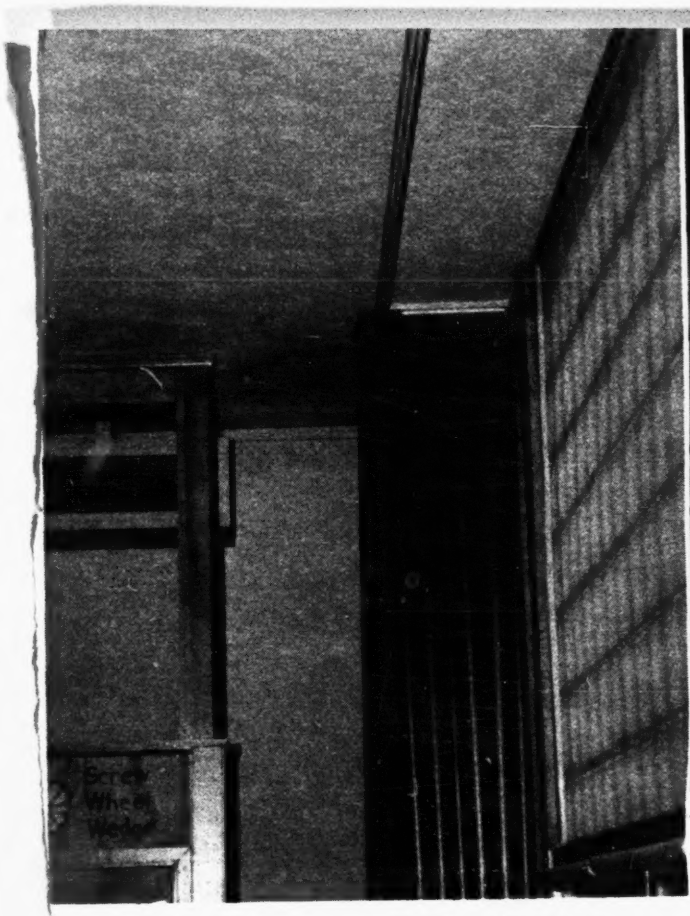
Additional advantages claimed for certain types of plastic drapes include the following:

1. They are fire-resistant.
2. They are easily cleaned.
3. They permit use of light weight track which is easily installed.
4. They are less expensive than woven cloth drapes.

Some limitations of drapes should be mentioned.

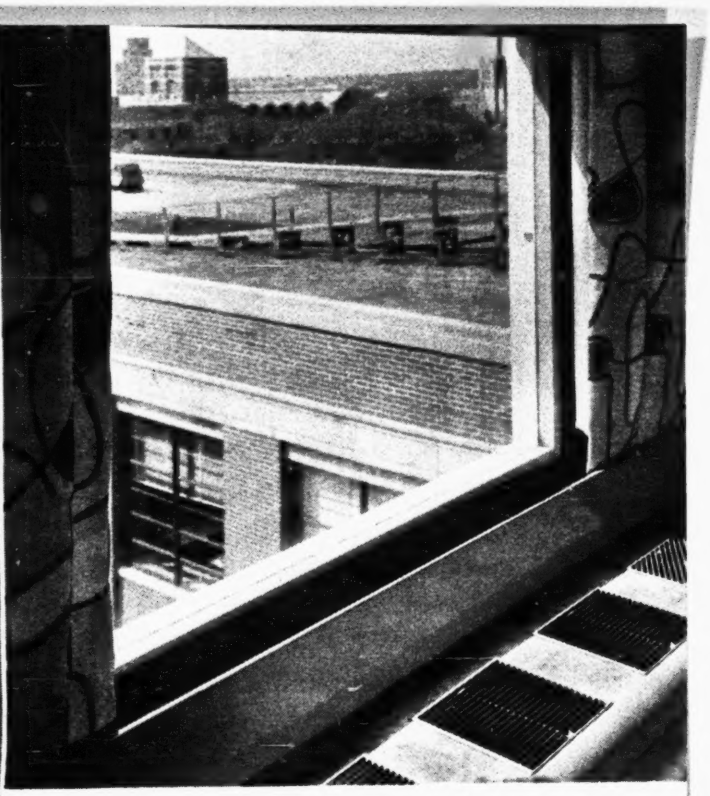
1. Some types are bulky.
2. They collect dust and must be cleaned periodically.
3. Cloth drapes need to be made fire-resistant.
4. They do not provide for control of sky-glare when not needed for room "darkening." (A double installation of translucent drapes to cut window or sky glare plus opaque drapes to give more complete light control, takes care of this "limitation.")

In rooms with adequate mechanical ventilation devices, drapes may be installed close to the window wall and may extend down only to the top of the window cabinets or sills, provided the drapes drop behind a low baffle extending above the level of the cabinet or the sill. (see page 23)



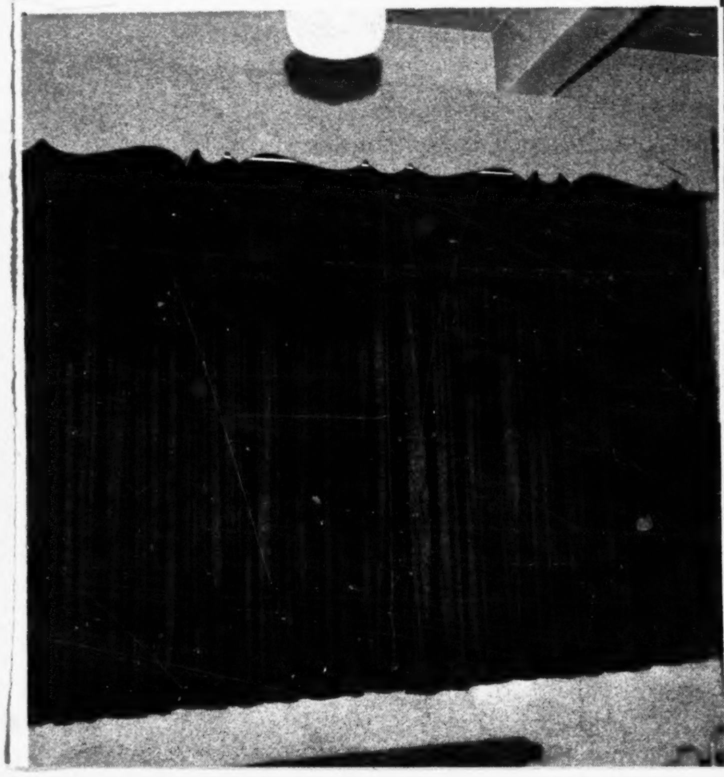
St. Louis Public Schools

Drapes properly mounted to fall free of window shelves and ventilator.



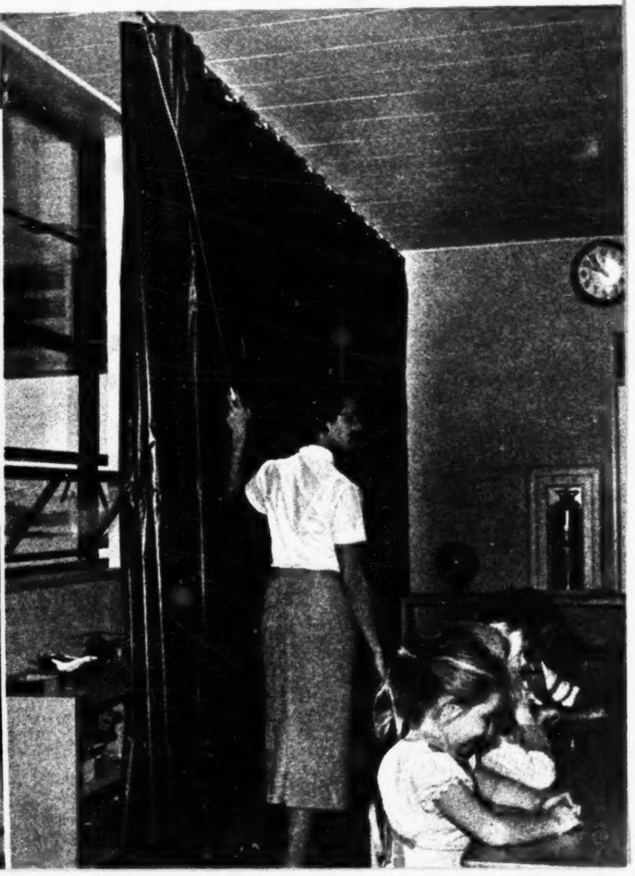
American Air Filter Co.

Low baffle prevents blowing of drapes installed above vents of a unit-ventilator.



St. Louis Public Schools

Light leaks at top of this drape installation are prevented by a decorative valence.



San Diego City Schools

Drapes installed 12 to 18 inches out from windows to allow free flow of air without excessive light leakage.

When windows are used for ventilation, tracks for drapes should be installed about 12 to 18 inches out from the windows. Drapes in this case should be secured at each end and overlapped 8 to 12 inches in the middle to prevent light leaks. Such installation will provide light control while allowing air to enter the room through open windows.

Pleats may add to the esthetic quality of the installation, especially when the drapes are drawn, but they are not needed for light control and add 50 to 100 percent to the cost of material. In addition, pleated drapes are often bulky and difficult to draw back so as to free all wall area.

Satisfactory drape installations can be made both with and without traverse control cords, but the installation of such cords is a good investment, because the drapes are easier to open and close and there is less chance that edges of the drapes will be damaged.

Drapery track should be selected on the basis of the service it will be called upon to perform. It is a mistake to install a light weight track to support a heavy drape. On the other hand, a very heavy track is not needed for light weight drapes. Some tracks have the advantage of bending easily so that they can be installed to allow the drapes to be pulled around a corner to stand against an unused wall when not in use.

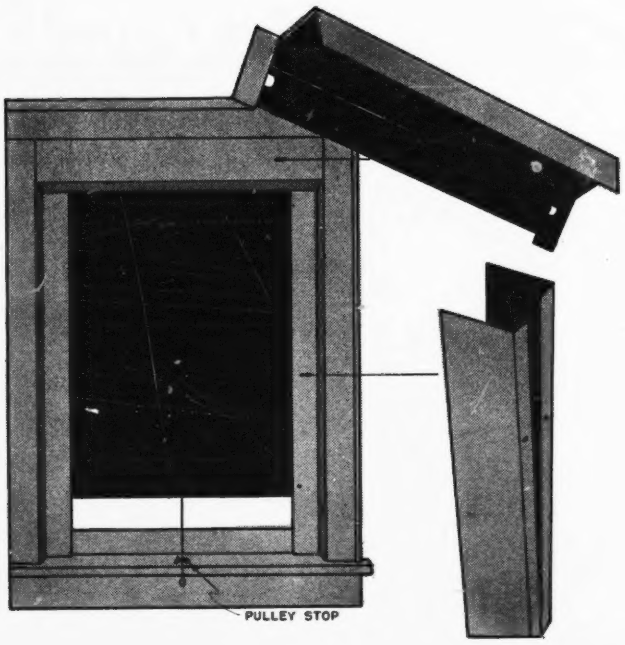
Shades—The most common type of opaque shade is the permanently installed rolled type. For complete satisfaction, most installations require special flaps or channels to eliminate light leaks. These channels may be made of wood or metal. Hinged flaps are recommended since they are less likely to fray or tear the edges of shades.

Portable shades which can be moved from room to room are definitely not recommended. They represent a makeshift arrangement with most of the disadvantages of the old single "projection room" concept of audio-visual education. The number of teachers able to use projected materials at one time is limited by the number of sets of portable shades. Class time is wasted in preparatory activities, and in general ease of the using materials is reduced.

The following advantages and limitations of roller shades should be noted:

1. Advantages
   a. Easy to operate when properly installed
   b. Available in colors and may, therefore, be planned to add to the attractiveness of a room
   c. Less expensive than other means—for use in older classrooms which have relatively small window area to cover
   d. May be adjusted to control excess light and sky-glare for classwork other than viewing pictures.

2. Limitations
   a. Are often not efficient in light controls, especially for classrooms of new type construction
   b. Are susceptible to damage
   c. Hinder window ventilation
   d. Difficult to adapt to sky-glare problems



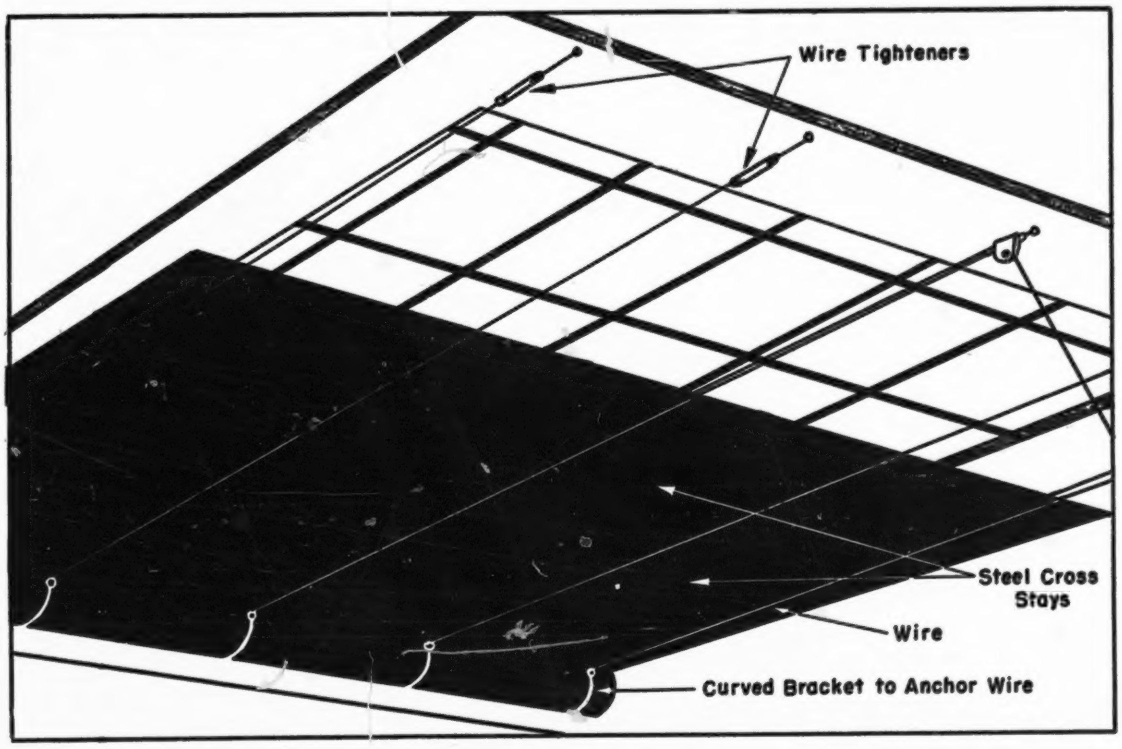
Opaque roller shades are available in several colors, and are effective when used with light arrester channels or flaps. A pulley stop on the shade cord is more desirable than a catch on the spring roller.

Thomas E. Batson

Roller shades may be made of canvas, of light weight fabric, or of oilcloth. Canvas is durable, but it requires a strong spring roller, rolls up into a large clumsy roll, and is costly. Oilcloth shades tend to "pinhole" easily. Light weight opaque shade fabrics having neither of these disadvantages may be obtained.

Full-Closure Venetian Blinds, Adjustable Louvres, and Jalousies— The ordinary type of Venetian blind is *not* satisfactory as a means of controlling light for projection purposes unless combined with a drape installation. There are, however, now available new types of full-closure Venetian blinds and jalousies especially adapted to the problem of classroom light control.

Some of these newer types of full-closure Venetian blinds have broader slats than the common variety of Venetian blind, and in some instances the blinds are so constructed that they close to form a trap, thereby shutting out light more completely than the ordinary type of Venetian blind while still allowing a certain amount of air to circulate. These newer types of Venetian blinds are more efficient for complete light control when mechanical rather than window ventilation is employed.


Wire Tighteners
Steel Cross Stays
Wire
Curved Bracket to Anchor Wire

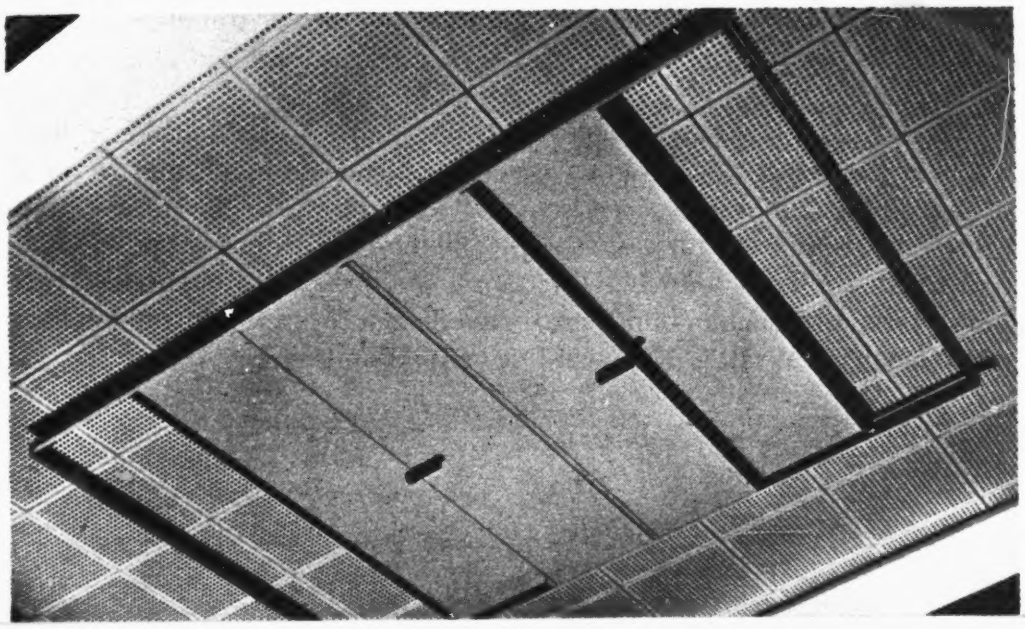
Thomas E. Batson

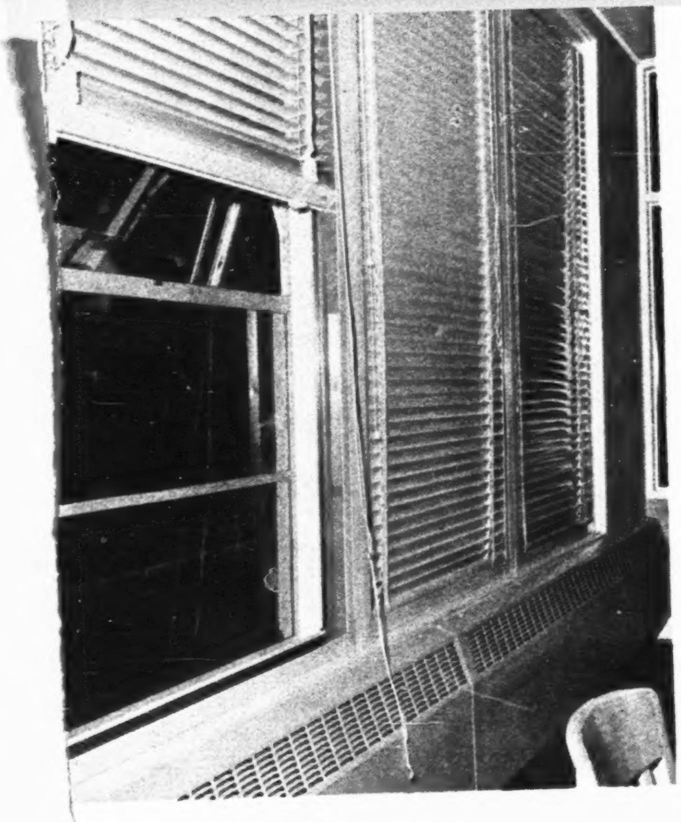
Roller shade designed to control skylighting.

Adjustable louvres can be an effective method for controlling light coming through skylight and clerestory installations. Louvres may be of wood or metal and must be adjustable by levers or cranks installed conveniently in the classroom. Louvres and jalousies made for installation outside buildings are not suitable for use in climates where snow and ice are common.

Easily operated mechanical device for "darkening" skylight in classroom.

Mackin Venetian Blind Co.





Full-closure Venetian blinds to solve the problem of window light control.

San Diego City Schools

Summary—The Committee on Non-Theatrical Equipment of the Society of Motion Picture Engineers makes the following statement:

"Standards of quality in educational projection ought, if anything, to be higher than those in the theatrical motion picture field. The pupil does not come to the classroom to be entertained, but to learn. In order to learn from the screen, he must watch it diligently, even though he may happen to be seated in a position that affords him only an oblique and distorted view of the picture. In order to learn from the sound, he must be able to understand reproduced speech without effort, and he must be able to obtain a true impression of the character of natural sounds and of the tone qualities of musical instruments when these are used in the films.

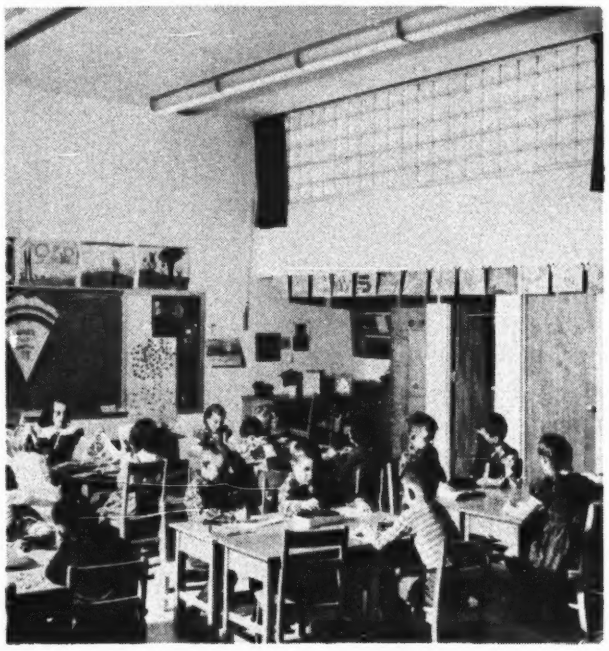
In a motion picture theatre, if one has to sit in an unfavorable location, as a rule he is subjected to this annoyance for only a single performance. In the schoolroom, however, he may be required to keep the same seat day after day. If this seat does not give him a good view of the picture and a good opportunity to hear sound, he is under a permanent handicap.

It is because of these considerations that in several instances this report recommends narrower limits than are commonly accepted in theatrical projection practice. The Committee believes that in the educational field there should be no compromise with respect to the conditions that are necessary to secure substantially equal performance for all persons in the classroom."

In summary it may be stated that the following recommendations are supported by research:

1. Every classroom should be equipped for the effective use of projected materials.

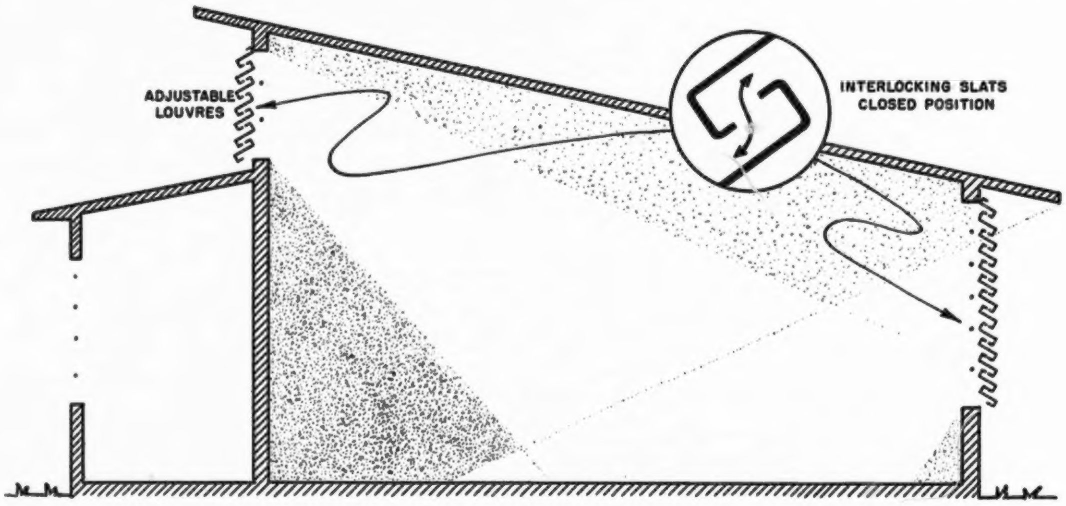
2. No system of projection has as yet been devised which permits satisfactory day-to-day use of the several projected picture mediums without light control facilities.
3. The light control installation should be such that the illumination in the room, particularly on the surface of the screen, may be limited to one-tenth foot-candle.
4. It is preferable that classrooms not be in total darkness; the level of non-projected light on the projection screen should probably not exceed one-half foot-candle at any time.



Pull drapes and full-closure Venetian blinds or louvres can control clerestory lighting successfully.

American Council on Education

Thomas E. Batson



Air Climate

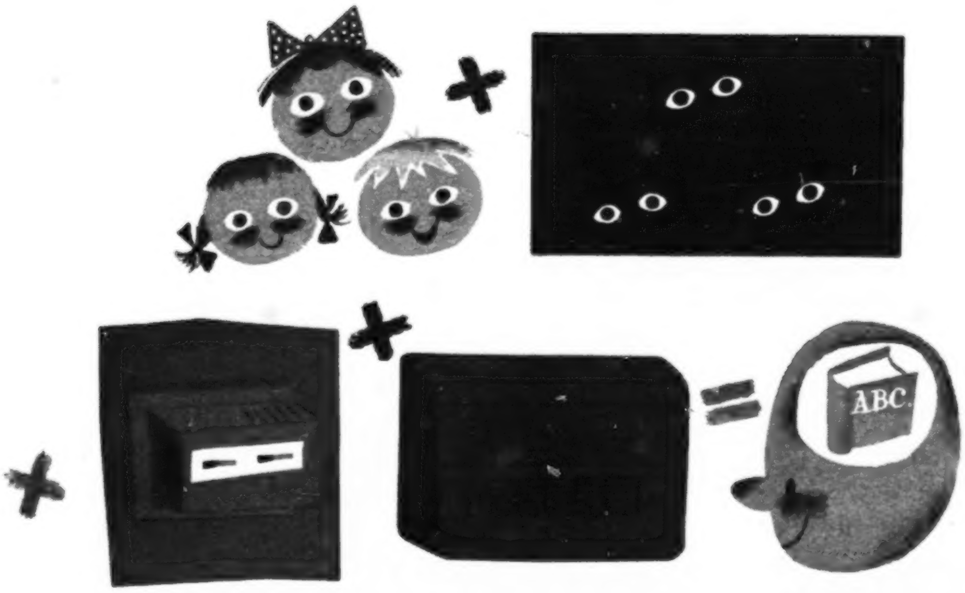
Poor ventilation and improper room temperatures create uncomfortable and, in some instances, unhealthful classrooms. Discomfort alone has long been known to be a serious distraction factor in learning situations. In more active classroom programs, including the use of projected pictures in the classroom, this distraction factor sometimes becomes acute where ventilation and temperature controls are disturbed by closing off windows and doors.

In the modern school building, where an extremely wide range of activities takes place at any time of the day—including motion pictures in some rooms and possibly singing or square dancing in others—it is quite unlikely that proper control of ventilation and temperature can be achieved without provision for individual automatic classroom unit control.

The optimum room climate for projecting pictures in "darkened" rooms is the same as for other kinds of learning: the air should be fresh smelling, not excessively humid, and the temperature held within rather narrow limits. In school classrooms, the most important function of ventilation is the maintenance of a proper temperature. Poorly ventilated schoolrooms become "stuffy" not because of any chemical deficiency of the air—such as lack of oxygen or excessive carbon dioxide—but because they get hot and humid. To avoid this, sufficient outdoor air must be admitted to balance bodyheat from the pupils, heat from the lighting system when lights are on, and solar heat, which tends to warm the room even when shades or curtains are drawn. Even in cold climates this normally necessitates the controlled admission of a good deal of outdoor air whenever classrooms are occupied—more than enough to take care of odor and humidity problems.

Where it becomes necessary to "darken" the room for a very short time only it is often possible, even in warm weather, to close the windows completely without noticeable warming of the room. However, in such instances the formula is a delicate one, since even a small rise in temperature tends to promote the distractions and "learning lethargy" which accompany physical discomfort. Trying to teach or to learn by any means in a room at a temperature of 80° and a high relative humidity is a discouraging and frequently a fruitless process. Consistent use of projected materials requires—as indeed does teaching of any type—suitable mechanical ventilation. (In this connection serious consideration should be given to making all new school buildings, the use of which will undoubtedly extend for 60 or more years, readily adaptable to air conditioning equipment.)

Good mechanical ventilation may be defined as some means for introducing a sufficient quantity of cool air to each classroom to prevent overheating without causing uncomfortable drafts or distracting noises, even



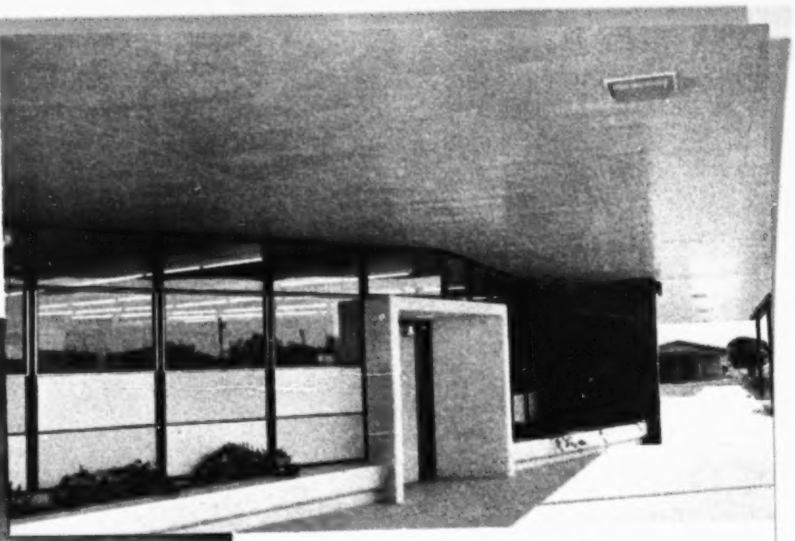
Minneapolis-Honeywell

Poor ventilation and improper room temperature create poor and sometimes unhealthful learning conditions.

when, as is often the case, classrooms in other parts of the school may simultaneously require heating. "Sufficient quantity," as used in this definition, may mean as much as six or seven, or even eight or ten complete air changes an hour, depending on the room heat gain.

The distinguishing feature of any system of ventilation which meets this definition is that it provides automatic *two way* temperature control. Unlike the familiar household heating system, it gives the thermostat not only the power to "turn on the heat" whenever the room is about to become too cold, but also the power to "turn on the cold" when the room threatens to become too hot—and it accomplishes this without interference with light control devices, without the distraction from wind-blown papers, and without the discomfort which results from opening windows in cold weather.

The heating-cooling "budget" of a typical classroom in cold weather is expressed in thousands of BTU (British Thermal Units). Heat given off by pupils, plus sun heat entering the windows (which warms the room even if curtains are drawn), more than compensates for "heat losses" to the outside by way of windows, ceiling, and floor, requiring ventilation cooling to hold the temperature inside at 75° with an outside temperature of 40°.



San Angelo, Texas Public Schools

All air-conditioned school, San Angelo, Texas.

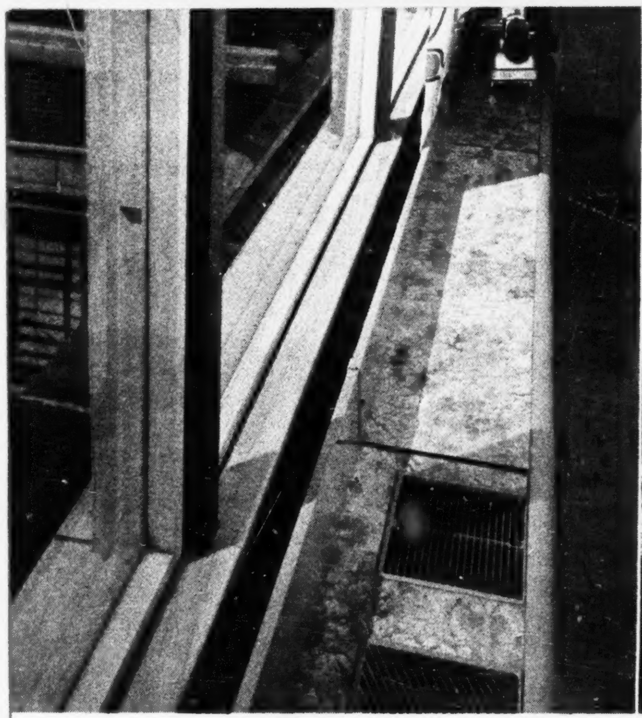
In this example, the heat-producing lighting system is turned off. Heat from a 500-watt projector would add about 1700 BTU. Drawn curtains reduce window loss to the outside, necessitating still more "excess" ventilation than that shown on graph.

A schoolroom unit ventilator, placed beneath windows on an outside wall, balances the "heat budget" automatically, under control of the room thermostat, providing just the degree of heating or cooling needed at all times, without causing drafts. Since air is drawn in beneath the window and blown towards the ceiling in front of the curtain, no darkening problem is created. A "light stop" baffle on top of underwindow cabinets covers gap at bottom of darkening curtains, thus avoiding a distracting line of light at the pupil eye level.

500 TO 800
B.T.U.s PER HOUR

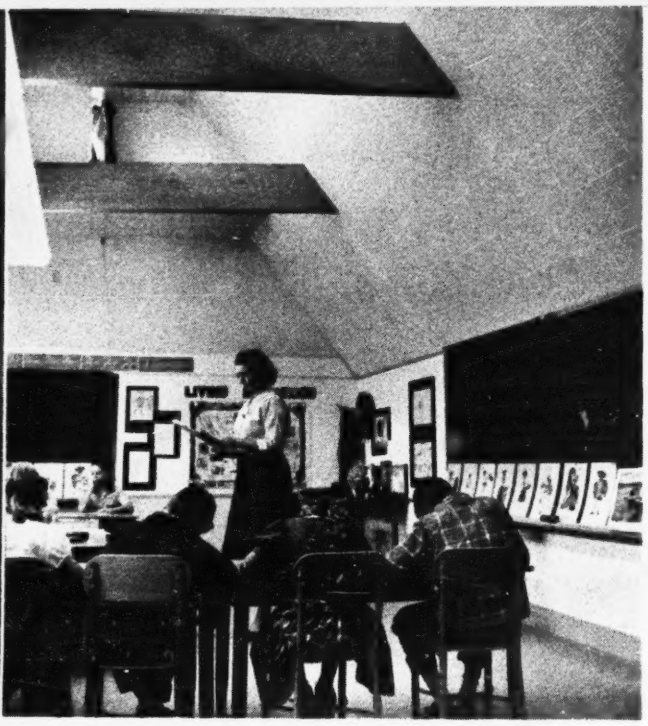
Each child in the classroom is a "little furnace" producing from 500 to 800 BTU's of heat each hour.

Owens-Illinois



Herman Nelson

Unit ventilator with light stop to catch drapes when drawn to darken room.



San Diego City Schools

Careful sound treatment prevents undue distraction.

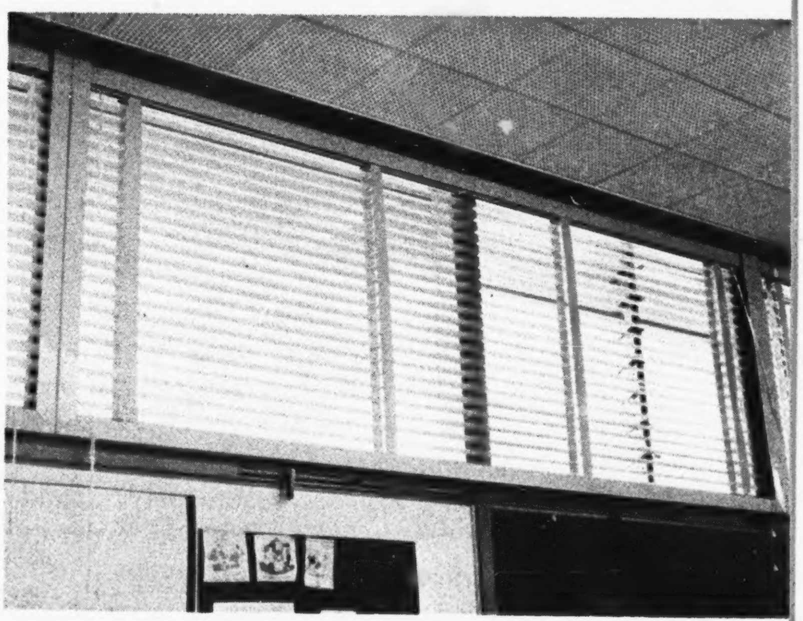
Sound

The greatly increased pupil activity that accompanies modern classroom procedure, as well as the growing audio part of the audio-visual program, has pointed up the need for attention to the importance of sound-treating all classrooms and other instructional areas. Sound motion pictures, or recordings, or radio broadcasts, or TV programs (either TV reception or the production of live programs in the room) are likely to show up at any time in any room in the building as a regular part of the classwork. For good use of such equipment within a classroom and to avoid undue distraction by the more active processes of students in other rooms, all classroom and laboratory areas should be carefully treated to reduce reverberation within the room and to reduce sound transmission from one room to another.

A satisfactory acoustical environment has been defined as one "in which the character and magnitude of all noises are compatible with the satisfactory use of the space for its intended purpose." Noise is defined as any unwanted sound. Noise level for classrooms should be no greater than 35 to 40 decibels at any time.

In the classroom the acoustical problem is largely dependent upon (a) keeping the background noise low enough to avoid interference with desired speech or music and (b) controlling reverberation time so that it will be short enough to avoid excessive overlapping of successive sound and yet long enough to provide some blending. These requirements, in turn, depend on proper acoustical treatment of the room itself and the control of noise from adjoining spaces.

Various rooms present different acoustic problems depending on such factors as the size and shape of the room, the furnishings, and the number of occupants. Reverberation time is the length of time necessary for a sound to die away after the source has stopped producing it. The limits of acceptable reverberation time for a classroom of 10,000 cubic feet ranges from 0.6 to 1.2 seconds. It is important that reverberation time be correct over a wide range of frequencies. A common imbalance is excessive reverberation at low frequencies and inadequate reverberation at high frequencies. The result is boomy yet dead, and music reproduction is particularly poor.



Room showing application of sound absorbing materials on ceiling.

San Diego City Schools

Reverberation time can be controlled inexpensively by the proper application of sound absorbing materials on ceilings, walls or floors or all of them. *An experienced acoustical engineer should be consulted to determine the required acoustical treatment of various classrooms.*

Problems of sound insulation may be most readily and economically solved at the time a building is being planned and constructed.

Sound insulation may be accomplished in part by skillful building layout, so that classrooms are removed from noisy areas such as gymnasiums, cafeterias, school shops, and music rooms. Further insulation may be gained through the use of proper wall materials, floor insulation, heat ducts, and service lines. Nonporous and rigid constructions for partitions and floor slabs must be adopted if appreciable sound insulation between rooms is expected.

It should be noted that "open classrooms," flexible walls, and partitions, as well as large window areas and open windows, create very real sound problems for the classroom.

EQUIPMENT

Wiring

It is impossible to anticipate what the wiring requirements of our classrooms will be even a few years in the future. It is safe to say that there will undoubtedly be an increase in the number of commonly used machines and instructional or learning-aid devices. Even in the present stage of development of audio-visual aids it has become evident that there must be provision for electrical outlets in *all* areas of *all* classrooms.

Also with wide use by schools of both broadcast and closed-circuit television just around the corner, no new building should be erected without ample wiring or conduit for classroom television equipment.

Electrical Switches and Outlets

In addition to switches regularly placed near doorways for the control of overhead lighting, an additional room light switch may be installed on the wall of the classroom opposite the side of the room on which the projection screen is mounted. This switch is convenient for providing immediate and easy control of room lights by the projectionist.

There should be several electrical outlets at the back, front, and side of the classroom. One of these outlets should be near the usual location of the projection stand. Outlets in the front are needed for such equipment as overhead projectors, record players, and tape recorders. Outlets at the side of the room will be needed for experiments and small group work.

Electrical outlets should deliver 110-130 volt alternating current and be fused for no less than 20 amperes. Lines serving the outlets should be separate from the lines serving regular overhead lights. Circuits should be so designed as to allow simultaneous use of equipment in any number of adjacent classrooms without overloading the circuits.

Here again it is unwise to establish the wiring specifications for any classroom on the basis of present uses of electrical equipment. Not only is it probable that teachers in such subject areas as algebra and foreign language will have ever increasing need for an "electrified" classroom, but a classroom inadequately wired today in anticipation of its use by teachers who have little present-day use for electric-powered equipment may become very quickly a highly inefficient teaching station for other teachers who have great need for such equipment.

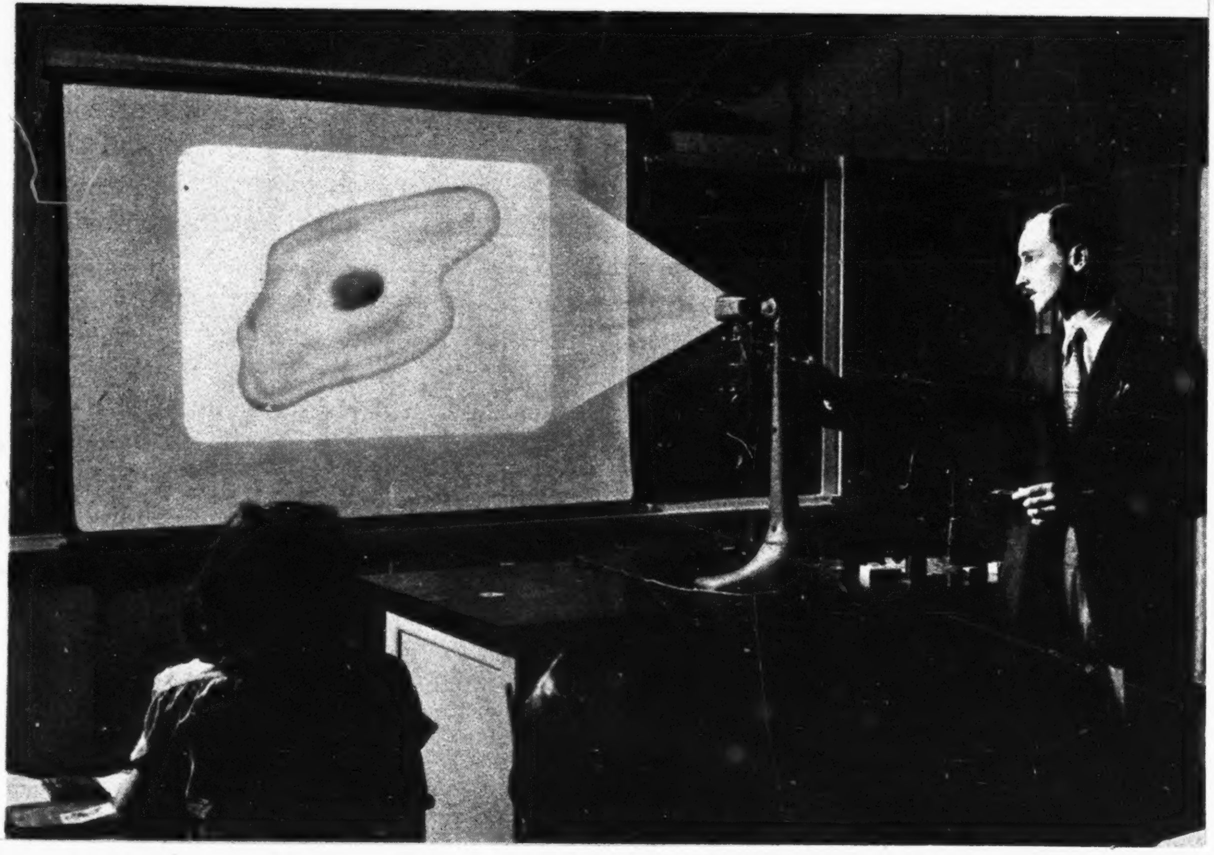
All electrical outlets should be installed at convenient heights above the floor, probably not more than 36 inches above floor level. No outlet

San Diego City Schools

Small group listening to playback requires electrical outlets where such activities can be carried on without undue distraction of class.

The microprojector is one of several pieces of equipment requiring an electrical outlet at the front of the room, and a high degree of light control.

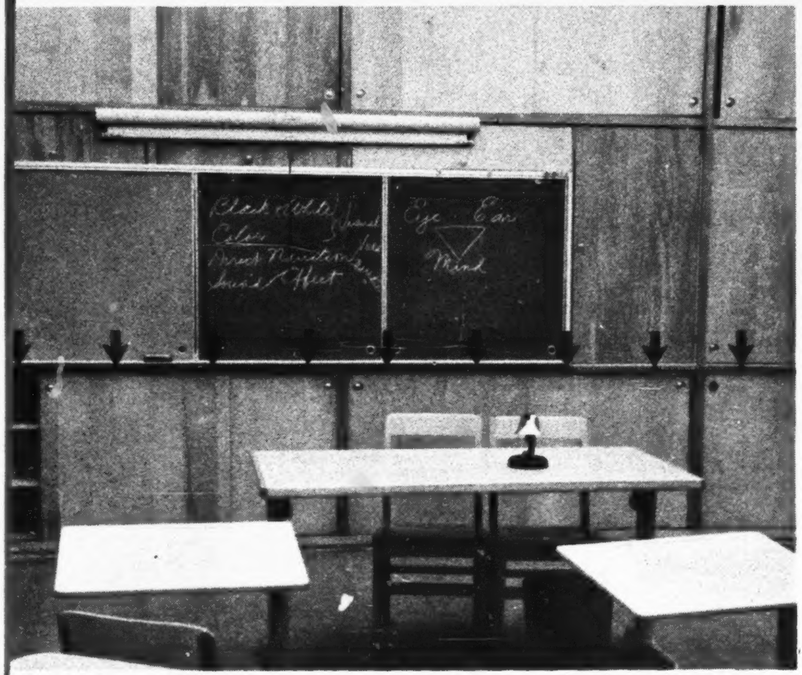
American Council on Education



should be on or near the floor where it is relatively inaccessible and where it is vulnerable to dirt, floor waxes, and cleaning operations. Whenever possible, circuit breakers should be used rather than fuses.

In summary it may be stated that a minimum of 12 double outlets should be included in every classroom. These outlets should be located as follows:

1. Three at the front of the room
2. Three at the rear of the room
3. Three on each side wall.



Use of "electric strip" provides for flexibility in use of electrical equipment in all areas of the classroom.

New York University

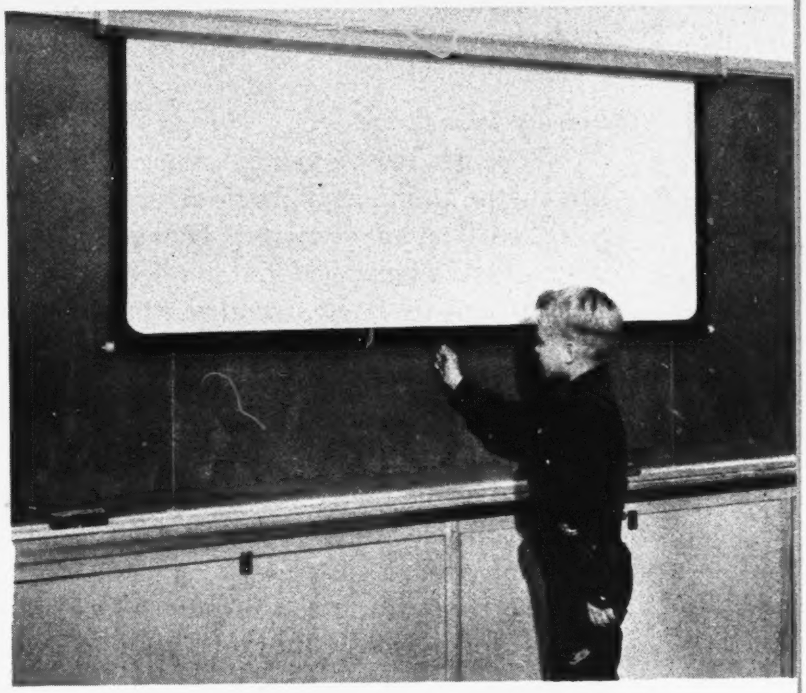
Screens

It is recommended that every regular classroom be provided with a projection screen which will accommodate projection by all types of classroom projectors. There may be a few teachers who do not use projected pictures. However, every room should be so equipped as to accommodate any teacher assigned to the room in the future.

The classroom screen should be of a type that can be made ready for use quickly and easily. It should be so housed that, when not in use, it will be protected from dirt and damage and be out of the way of other classroom activities. A pull-down screen in a roller case mounted on wall brackets will meet these requirements with effectiveness and economy.

Other types of installations, such as a flat mounted screen behind a movable chalkboard or bulletin board, if of adequate size, are also satisfactory. Tripod mounted screens provide a certain amount of flexibility in placement but are not recommended for general classroom use because such mounts are accident hazards and are space-consuming, time-consuming, and awkward.

The screen should be placed so that its lower edge when fully extended is near the eye level of seated pupils and so that no installation, such as ceiling lights, will interfere with the viewing. It should be so placed in the room that its surface may be darkened regardless of time of day or outside light conditions and so that it can be seen distinctly from all parts of the pupil-seating area. This condition is approximately fulfilled when no row of seats is wider than its distance from the screen. No viewer should sit farther from the screen than five or possibly six times the image width nor closer than two times the image width. It should be noted that many classrooms are so limited in area that good and healthful viewing by all members of the class is impossible.



A typical pull-down screen in roller case. The 70" by 70" size is recommended for most classrooms.

American Council on Education

Screen Size

In order to provide sufficient surface for *all* types of projection, a screen 70 inches by 70 inches is recommended at the present time for classrooms. At a distance of 30 feet the image from a 16mm motion picture projector using a 2-inch lens, or of a 35mm filmstrip projector using a 5-inch lens, almost fills the screen.

Square screens are recommended because they are more suitable for use with vertical slides and the variety of picture shapes encountered when using opaque, overhead, and micro-projectors. The pictures projected by such equipment tend to "spill over" the edge of a rectangular screen.

Although a somewhat smaller screen, no less than 50 inches wide, will usually satisfy the requirement for motion pictures that no viewer be farther than five times the width of the image from the screen, the 70-inch screen is recommended because it is needed for other types of projectors, for use with still pictures containing fine details which must be held on the screen for prolonged study, and for the use of motion pictures and filmstrips with groups of 35 persons or more.

Projection screens for use by small groups of 6 to 12 students working in project areas may, of course, be correspondingly smaller. Screens 36 to 40 inches square and mounted in spring-roller cases are satisfactory for such purposes.

Screen Types

Screens are of 5 general types: The "white matte" screen, the beaded screen, the aluminized plastic screen, the new "wide-angle" screen, and the so-called "daylight" screen. Detailed information on the characteristics which should be considered in selecting screen types are discussed in such publications as *Recommended Procedure and Equipment Specifications for Educational 16mm Projection,* and *The Architects Manual of Engineered Sound Systems.*

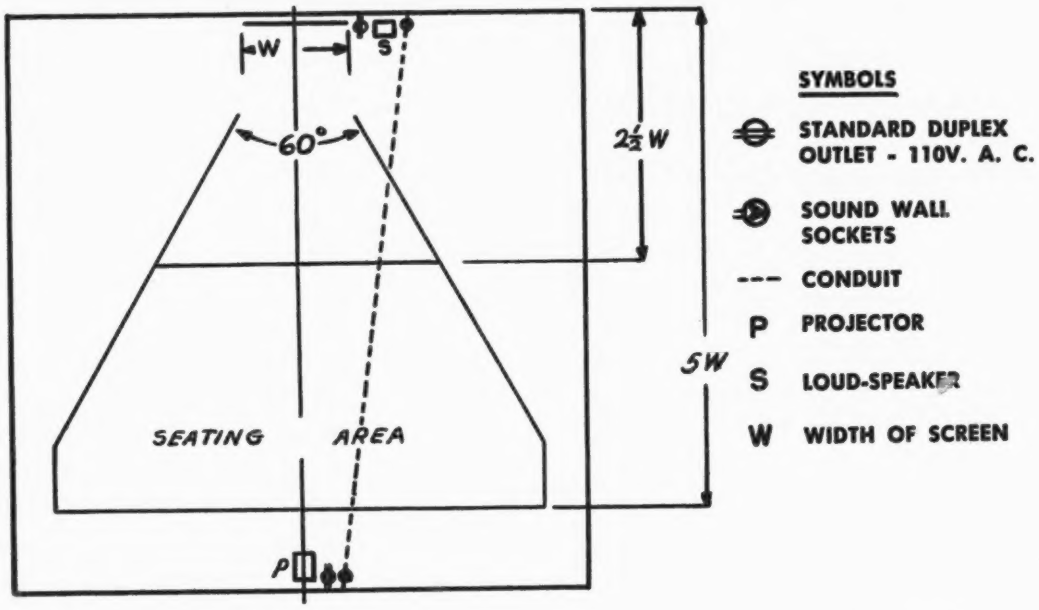
Matte Screens—Matte screens have smooth white surfaces. Many authorities recommend matte-white screen surfaces for square classrooms, stating that the image can be seen clearly and without distortion from all parts of the classroom seating area. The reflected light is distributed more uniformly from a matte-white screen than from a beaded screen, but the image on a matte screen surface is less brilliant than on a beaded screen surface for persons sitting at an angle of less than 22 degrees from the center of the screen.

Beaded Screens—Beaded screens have a surface covered with small glass beads which have the property of reflecting and at the same time refracting light in such a way that a high proportion of the light is sent back in the direction from which it comes.

Because of the greater reflective power of the beaded screens a brighter image is obtained than on a matte screen for persons seated not more than 22 degrees from the center of the screen. However, the picture brightness tends to fall off rapidly as the viewer moves out from the center of the screen so that at angles beyond 22 degrees the image on a beaded screen is less bright than on a matte screen.

As beaded screens are used there is a tendency for the beads to be knocked off, thus lowering the overall reflective power of the screen and producing a surface that gives a blotched appearance to the reflected image.

Aluminized Plastic Screens—These screens present a higher reflection factor than beaded screens and in general have the same limitation of



Thomas E. Batson

When viewing projected pictures, the audience should be no closer than 2½ image widths, and no farther than 5 image widths from the screen. No one should sit more than 30 degrees from a line perpendicular to the center of the screen.

viewing angles as the beaded screen.

Wide Angle Screens—These screens are at present adaptable to only wide angle motion picture projectors and films. Such equipment and material is not now readily available in schools.

"Daylight" Screens—Several types of screens are on the market today which claim to permit satisfactory projection of pictures in the classroom without special light control installations. This group includes the hooded screen or shadow-box type, the rear projection screen, and screens using various improved surface materials of glass, silver, plastic over aluminum, etc. *To date, none of these can be recommended as a substitute for room light control; however, they are often useful for small group projection.* Through classroom experience audio-visual directors have found the following advantages and limitations of "daylight" screens:

1. Advantages
    a. Make possible projection of some materials by high intensity projectors in a lighted room.
    b. Facilitate use with a *small* group within a classroom.
2. Limitations
    a. Such screens are not a substitute for an all-purpose *classroom* screen.
    b. Such screens do not eliminate the need for classroom "darkening."

c. Screen size is limited in most types to 40 by 40 inches or less, thus limiting the size of audience to less than class size.
d. The small screen size eliminates use of most opaque projectors and of large detailed images.
e. These types are not readily adaptable to use of the overhead projects with normal-size class.
f. Some types will produce a satisfactory image only for those persons sitting in a very limited area of the classroom directly in front of the screen. For other seating locations the picture is distorted or insufficiently illuminated.
g. Some types, such as those of glass, are breakable, heavy, or both, thus reducing the degree of portability.
h. The cost of such equipment is high for this limited use.

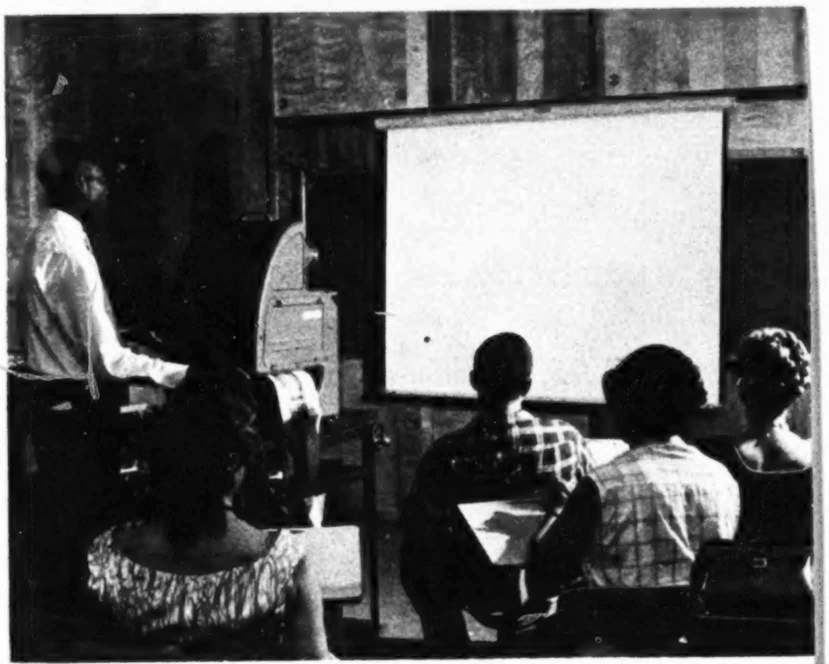
Projection Stands

It is advisable to have a movable projection stand in each classroom. A projection stand is a useful and adaptable piece of classroom furniture capable of holding projectors, tape recorders, record players, radios, and other objects used in the classroom.

Movable projection stand.

San Diego City Schools

The stand should be capable of holding 85 to 100 pounds and should remain steady in spite of the vibration of a running 16mm sound projector. The stand should be from 3 to 3½ feet above the floor. The inclusion of one or two shelves, hooks for cables, and film can pockets will increase its utility. The dimensions of the top of the stand should be not less than 18" x 24". The stand should be mounted on three to four-inch rubber wheels and should be equipped with adequate braking facilities so that it will stay in position even if used on a slightly sloping floor.



Movable projection stand.

San Diego City Schools

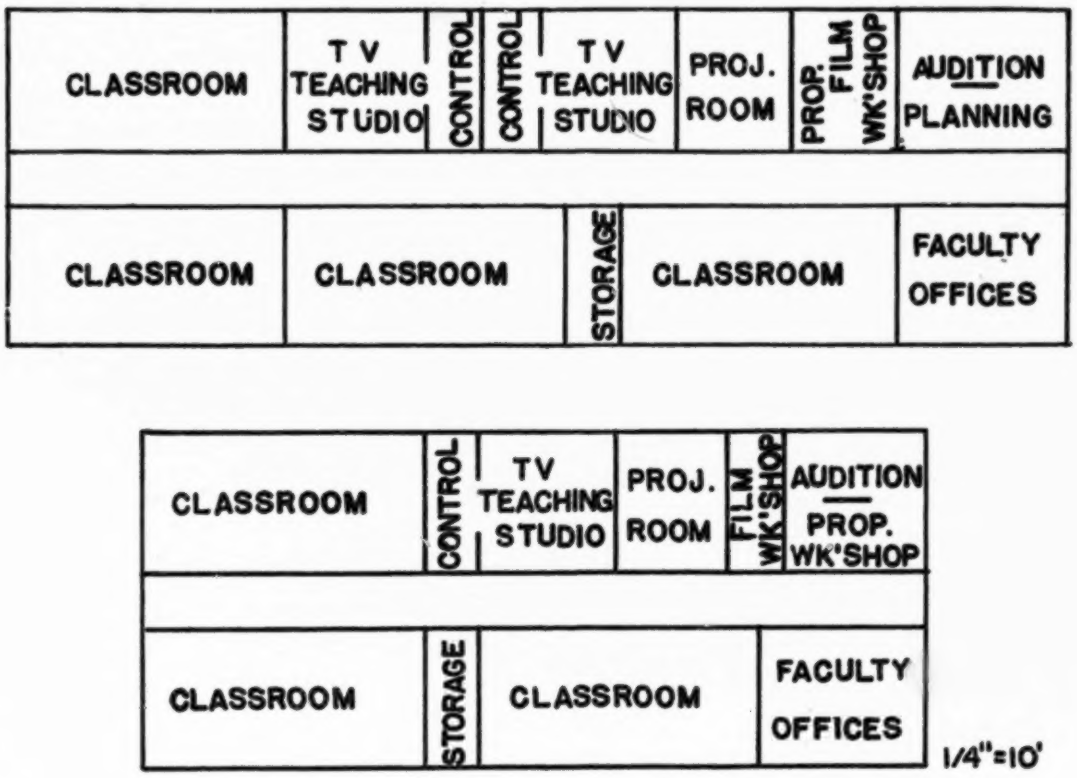
Speakers

Speakers permanently installed in the walls of the classroom are not generally recommended. The efficiency of many speakers tends to decrease with age. Furthermore, a speaker which will match the impedance and power output of one piece of equipment cannot be used indiscriminately with other equipment. For these and other reasons it is best not to install a permanent speaker but rather to install a speaker conduit to eliminate the stringing of long cables across the floor of the classroom.

It is often desirable to install a bracket or drop shelf which may be easily reached without standing on a chair or other object, that will fold against the wall when not in use. Such a shelf should of course be of sufficient size to hold any normally used classroom type of speaker. However, for classrooms of ordinary size the speaker may well be set up near the projector at the rear of the room. A location near the projector has the additional advantage of avoiding long speaker cords on the floor in rooms in which speaker conduits have not been provided.

IN-SCHOOL TELEVISION

Television, both broadcast and closed-circuit, is now being used in many of the nation's schools. Through proper planning before contracts are let, it should be possible to provide the potential of both open and closed-circuit television to any and all classrooms with little extra cost. To accomplish this, TV cable conduit should be installed to each room or location where the use of television is anticipated. The installation of such conduit at the time of construction makes possible the pulling of coaxial cable either immediately or at any future time. Conduit should be adequate for coaxial cable plus any other anticipated system of communication such as public address or radio antenna leads.


CLASSROOM
TV TEACHING STUDIO
CONTROL
CONTROL
TV TEACHING STUDIO
PROJ. ROOM
PROP. FILM WK'SHOP
AUDITION
PLANNING
CLASSROOM
CLASSROOM
STORAGE
CLASSROOM
FACULTY OFFICES
CLASSROOM
CONTROL
TV TEACHING STUDIO
PROJ. ROOM
FILM WK'SHOP
AUDITION
PROP. WK'SHOP
CLASSROOM
STORAGE
CLASSROOM
FACULTY OFFICES
1/4"=10'

New York University

Suggested one and two studio TV teaching center arrangements readily converted from usual classroom construction.

School Planning Magazine, DuKane Corp.

Drawing of distribution system for broadcast and closed-circuit TV.

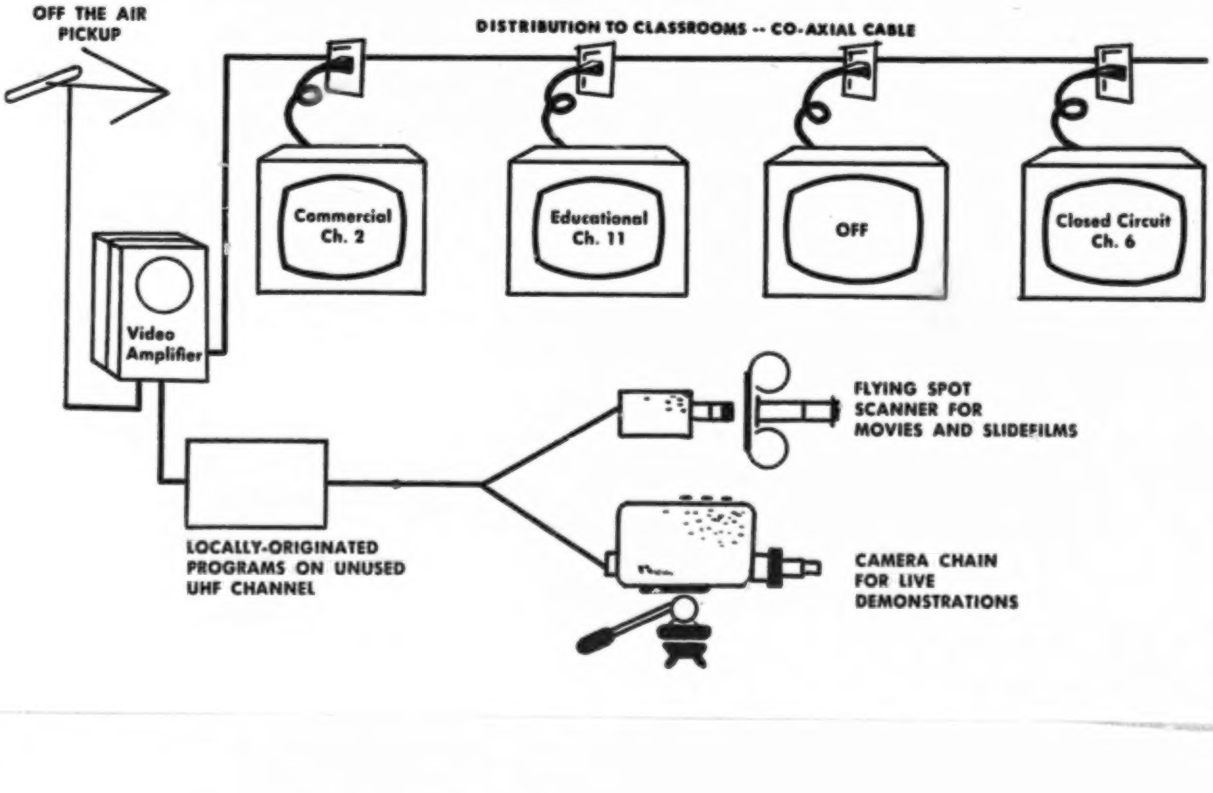
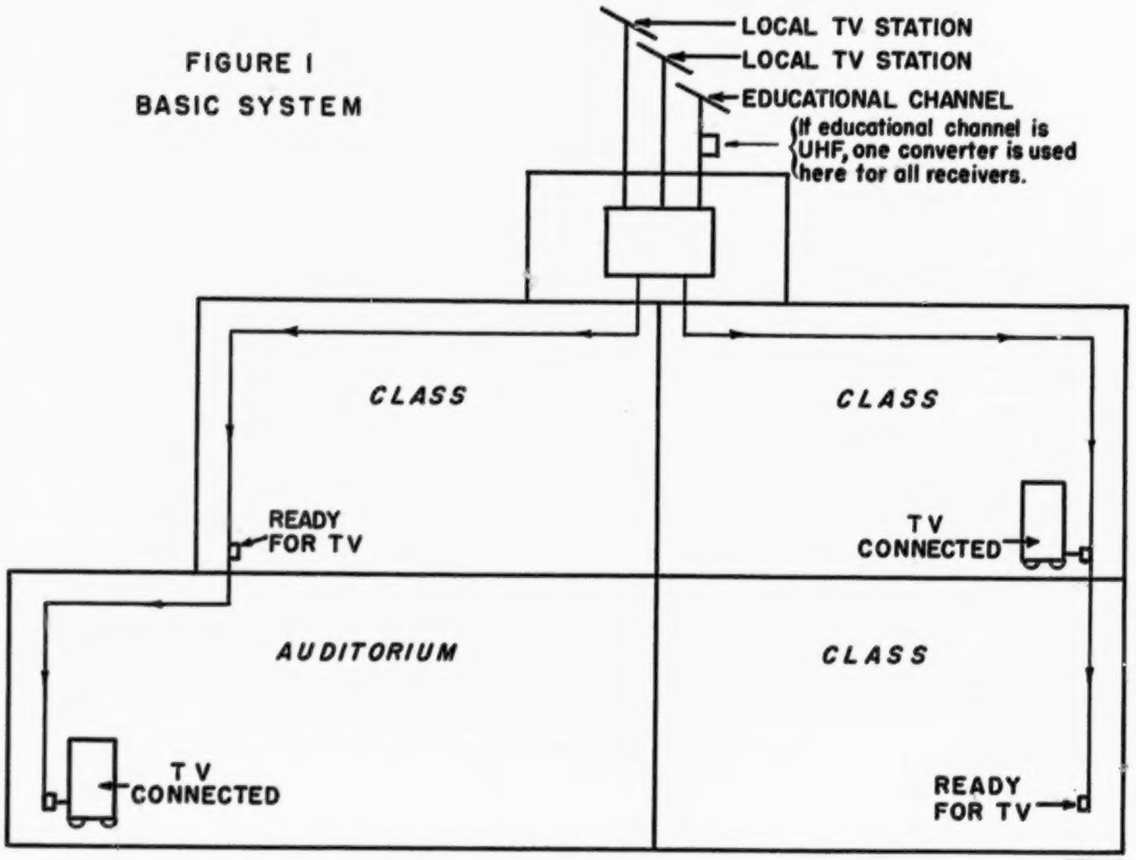

OFF THE AIR PICKUP
DISTRIBUTION TO CLASSROOMS -- CO-AXIAL CABLE
Commercial Ch. 2
Educational Ch. 11
OFF
Closed Circuit Ch. 6
Video Amplifier
FLYING SPOT SCANNER FOR MOVIES AND SLIDEFILMS
LOCALLY-ORIGINATED PROGRAMS ON UNUSED UHF CHANNEL
CAMERA CHAIN FOR LIVE DEMONSTRATIONS

FIGURE I
BASIC SYSTEM

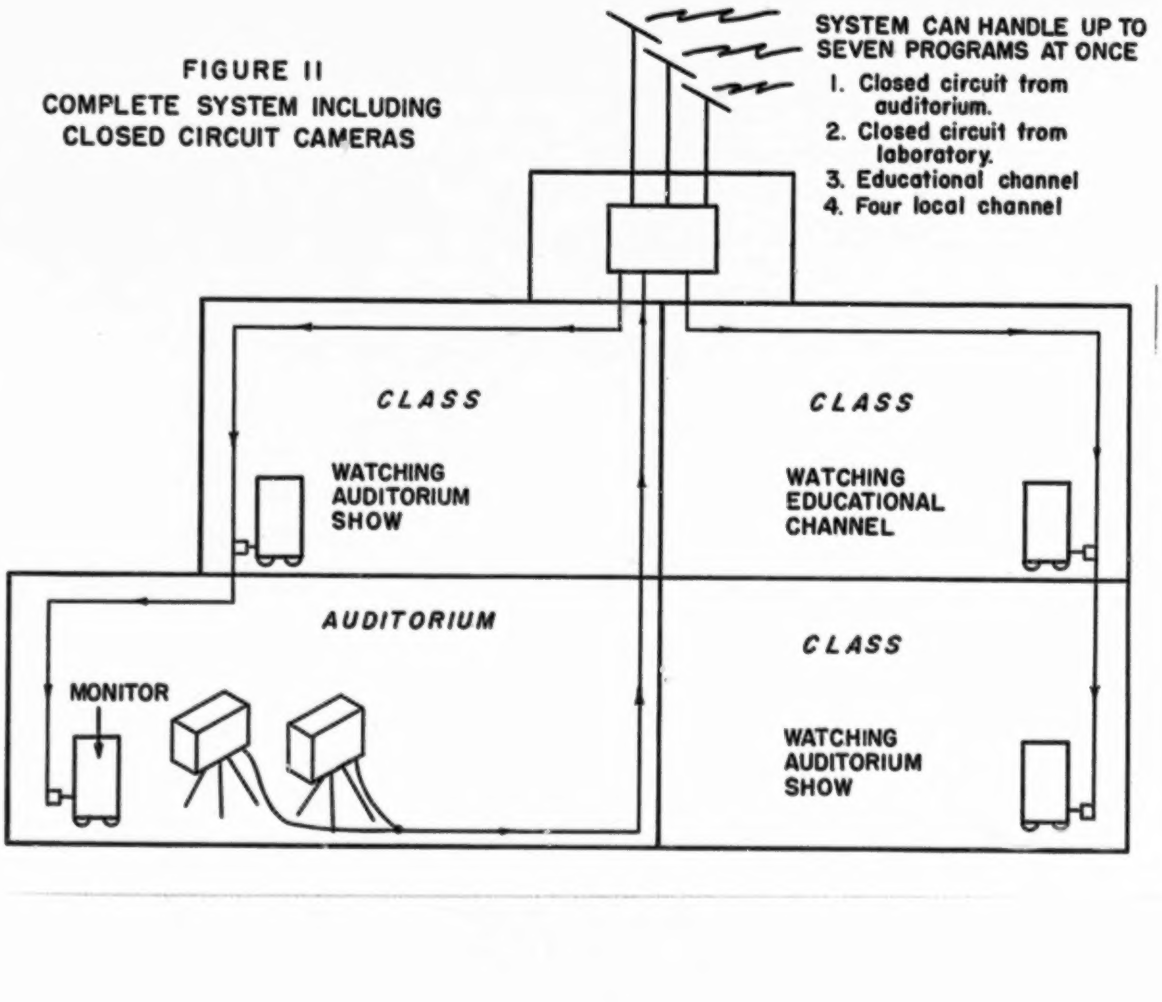

LOCAL TV STATION
LOCAL TV STATION
EDUCATIONAL CHANNEL
(If educational channel is UHF, one converter is used here for all receivers.
CLASS
CLASS
READY FOR TV
TV CONNECTED
AUDITORIUM
CLASS
TV CONNECTED
READY FOR TV

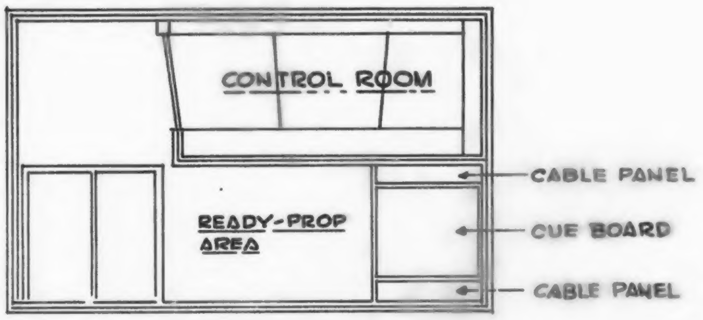
New York University

Schematic drawings of 2 TV hook-up systems.

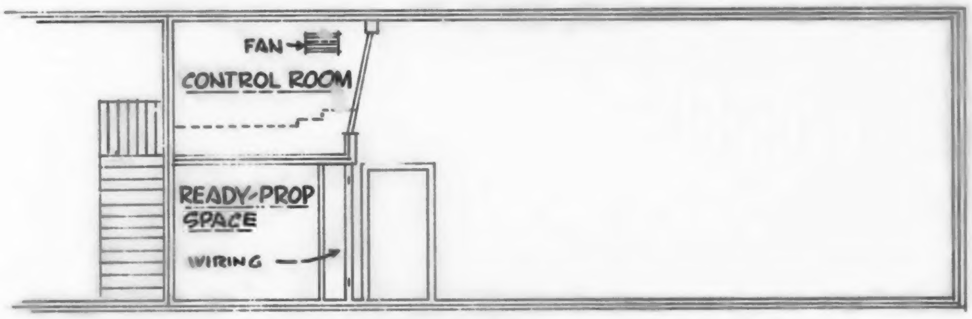
New York University

FIGURE II
COMPLETE SYSTEM INCLUDING
CLOSED CIRCUIT CAMERAS

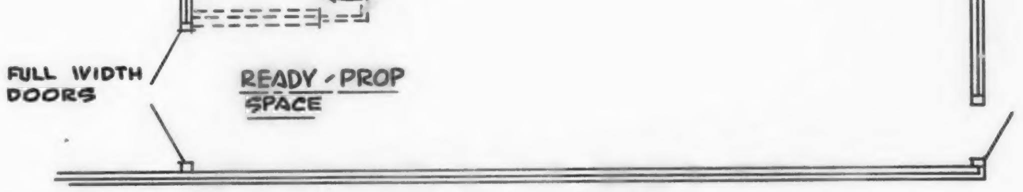

SYSTEM CAN HANDLE UP TO SEVEN PROGRAMS AT ONCE
1. Closed circuit from auditorium.
2. Closed circuit from laboratory.
3. Educational channel
4. Four local channel
CLASS
WATCHING AUDITORIUM SHOW
CLASS
WATCHING EDUCATIONAL CHANNEL
AUDITORIUM
MONITOR
CLASS
WATCHING AUDITORIUM SHOW


CONTROL ROOM
READY-PROP AREA
CABLE PANEL
CUE BOARD
CABLE PANEL

• ELEVATION • (SHOWING ELEVATED CONTROL ROOM & OUT-OF-VIEW READY-PROP AREA)


FAN
CONTROL ROOM
READY-PROP SPACE
WIRING

• ELEVATION •


UP
ELEVATED CONTROL ROOM (VENTILATED)
READY-PROP SPACE BELOW
TV PRODUCTION STUDIO
FULL WIDTH DOORS
READY-PROP SPACE

Floor plan of an educational television production area, which may be used as an auxiliary classroom.

New York University

Receiving Equipment

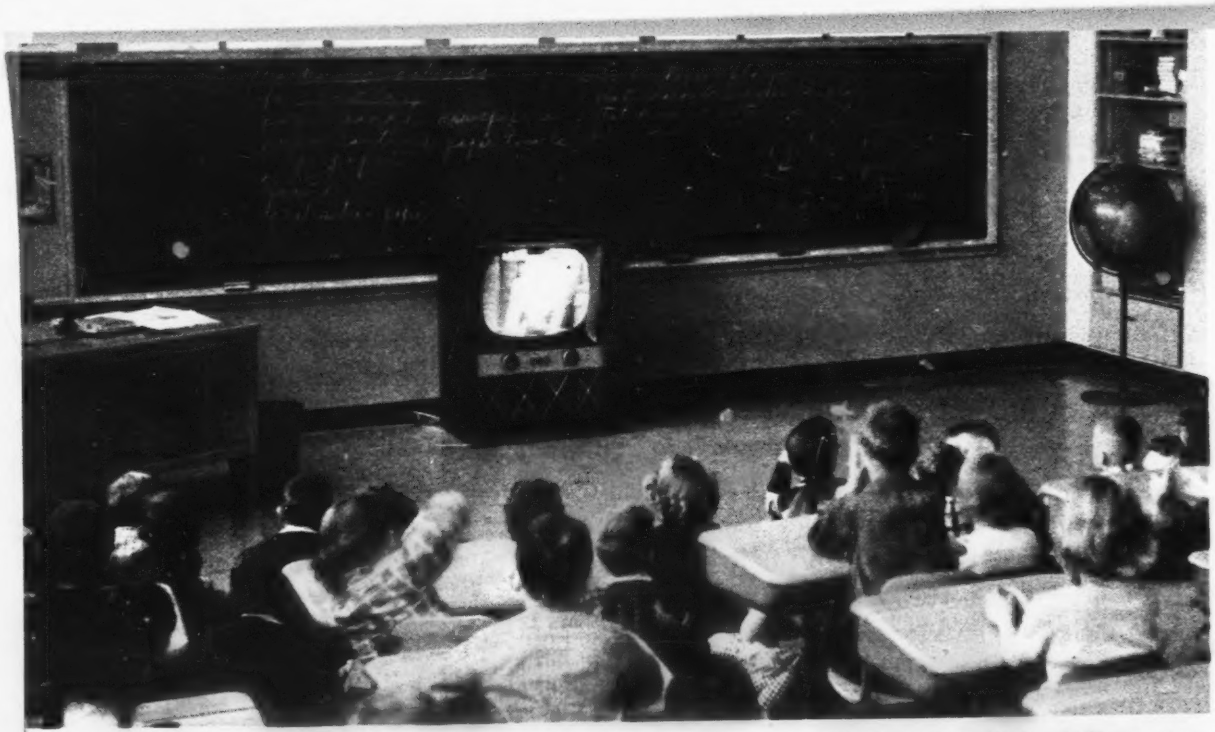
Most authorities are agreed that it is better to move the TV set into the classroom than to move the students into a TV "viewing room." This can be accomplished by mounting the receivers on large rubber casters that permit free and convenient movement from room to room. It is important that each floor be equipped with a sufficient number of sets to meet the needs of teachers in such areas. Conventional VHF sets will permit reception of twelve signals (programs) simultaneously. These should be assigned to Channels 2 through 13. Should broadcast stations come in on channels other than these, the channel can be changed by the use of a simple amplifier assigned to the proper channel. Present practice would indicate that a good "rule of thumb" for classroom viewing is one 24 inch receiver for each 12 students. The efficient use of receiving equipment depends upon proper control of light from outside and inside sources.

Broadcast Television

In many classrooms dependable broadcast reception is not possible unless the receiver is connected to an outside antenna. This can best be accomplished by the installation of a master antenna system with a separate antenna oriented toward each TV broadcasting location. By feeding each antenna lead into a special amplifier tuned to one of the 7 channels, it is possible to increase signal strength to the desired level. The outputs of separate amplifiers can be joined for distribution to many classrooms over a coaxial cable system. Each classroom will need to be equipped with a wall box containing a coupler unit to prevent interaction between receiving sets. A terminal jack properly installed in each classroom will permit the receiver to be "plugged in" readily.

Class must be near enough to the receiver for comfortable viewing.

Lincoln School, Boone, Iowa



Woodburg School, Marshalltown, Iowa

Class must be near enough to the receiver for comfortable viewing.

Closed-Circuit Television

The coaxial cable system will permit the distribution of closed-circuit television signals emanating from either live cameras or from a film chain. While closed-circuit "programs" may originate in virtually any spot in the school, it is advisable that one or more rooms in the building be equipped to function as a studio. Also, it is desirable to locate the equipment for distribution on the film-chain in a room other than the studio.

Camera Pick-Up in Any Classroom

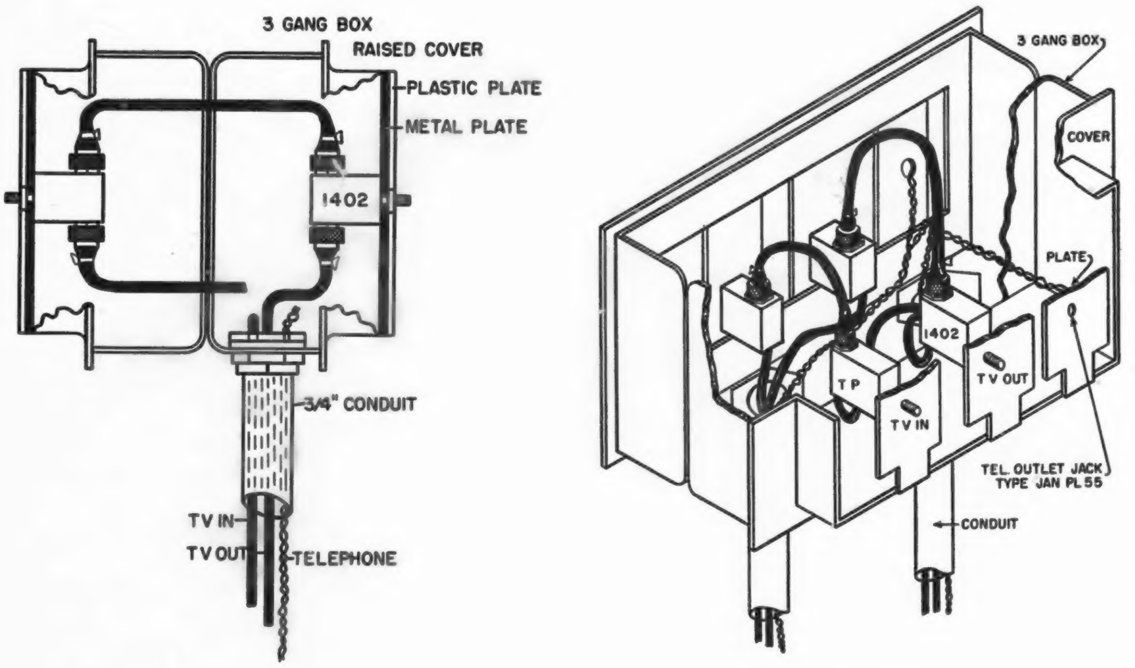
By installing a second coaxial cable system through the conduits it is possible to plug in a "videcon" camera in any classroom for the purpose of originating programs for use in any or all other classrooms.

Film Distribution

The film chain permits the projection of slides and 16mm sound or silent films into any number of classrooms simultaneously. It should be noted, however, that film distribution by TV circuit *cannot* provide for the highly flexible use of films in classes at the specific time at which individual classes need such films. Such day-by-day individual class use of such projected material requires individual classroom projection equipment.

Use of Closed-Circuit TV for Assemblies

Schools may avoid moving the students into a large assembly hall every time they wish to have an assembly program, pep meeting, etc., by having the "talent" come into the home rooms over closed-circuit television. This would necessitate having TV receivers accessible for each home room. The talent would appear before cameras in the school classroom studio. A closed-circuit installation could also be used to function as a television public address system for the use of school principals, supervisors, and other personnel in making announcements or addressing the student body. Such equipment might eliminate the need for an expensive and seldom used assembly hall.


3 GANG BOX
RAISED COVER
PLASTIC PLATE
METAL PLATE
1402
3/4" CONDUIT
TV IN
TV OUT
TELEPHONE
3 GANG BOX
COVER
PLATE
1402
T P
TV IN
TV OUT
TEL. OUTLET JACK
TYPE JAN PL 55
CONDUIT

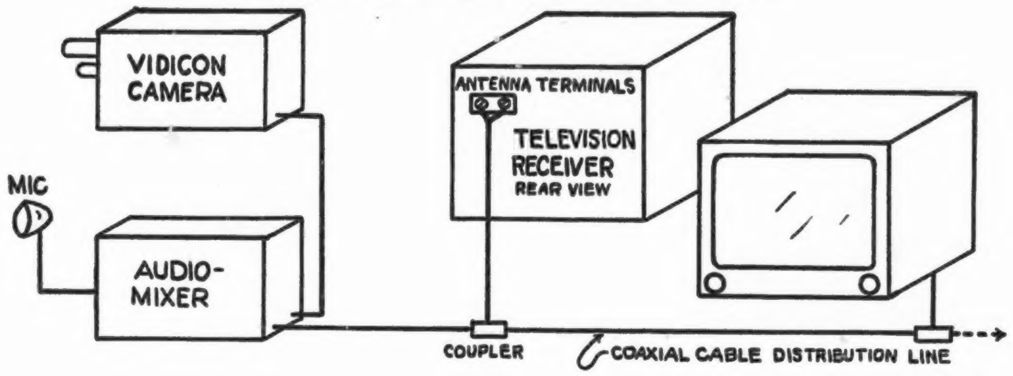
Jerrold Electronics Corp.

Detail of TV outlet, Case Institute.

Studios for Closed-Circuit TV

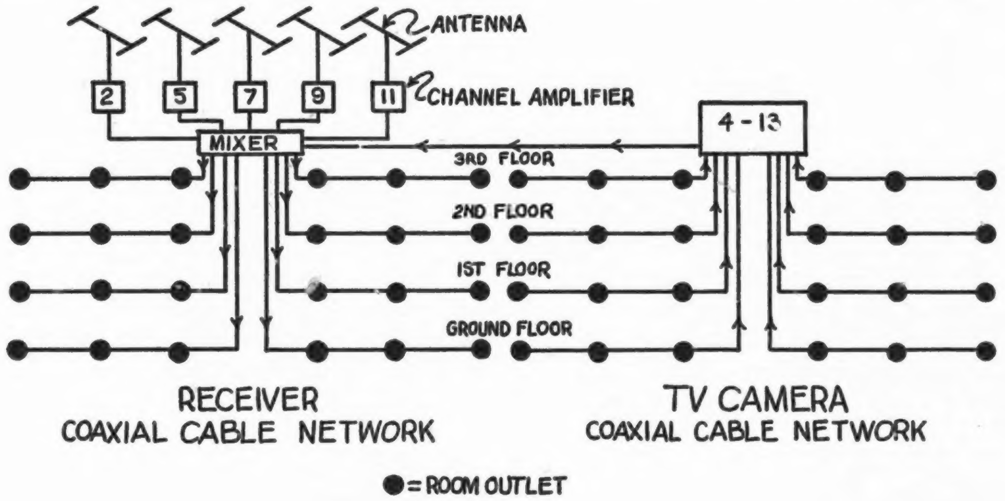
Many school-plant committees may wish to provide for television in studio rooms at the time of new building construction. If current curriculum plans do not call for television production, potential studio space may be used to advantage as extra classroom space until such time as television equipment is installed.

The following diagrams are suggestive of room provisions suitable for closed-circuit television.



BASIC CLOSED-CIRCUIT SYSTEM

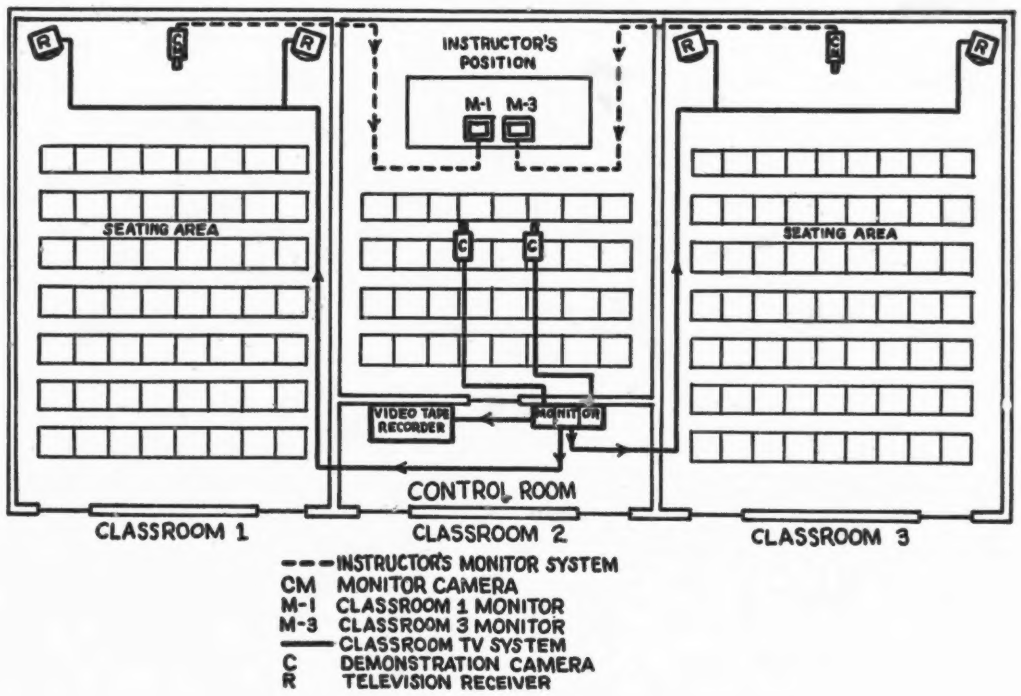
VIDICON CAMERA
MIC
AUDIO-MIXER
ANTENNA TERMINALS
TELEVISION RECEIVER REAR VIEW
COUPLER
COAXIAL CABLE DISTRIBUTION LINE



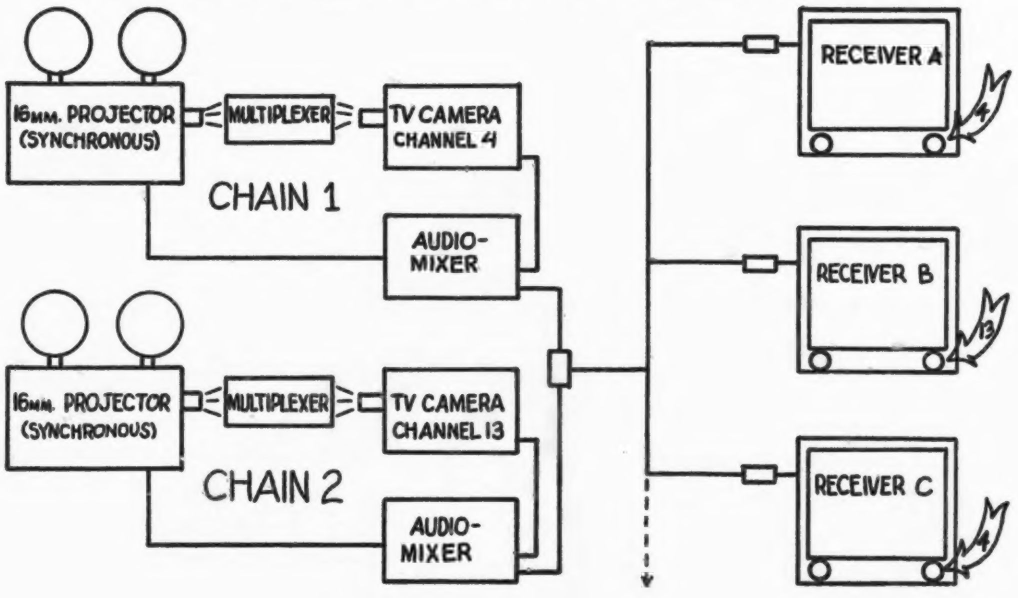
SCHOOL COAXIAL SYSTEM FOR CAMERAS AND RECEIVERS

ANTENNA
2
5
7
9
11
CHANNEL AMPLIFIER
MIXER
4-13
3RD FLOOR
2ND FLOOR
1ST FLOOR
GROUND FLOOR
RECEIVER COAXIAL CABLE NETWORK
TV CAMERA COAXIAL CABLE NETWORK
● = ROOM OUTLET

MULTIPLE CLASSROOM INSTRUCTION BY CLOSED-CIRCUIT TV


R
CM
R
INSTRUCTOR'S POSITION
M-1 M-3
R
CM
R
SEATING AREA
C
C
SEATING AREA
VIDEO TAPE RECORDER
MONITOR
CONTROL ROOM
CLASSROOM 1
CLASSROOM 2
CLASSROOM 3
--- INSTRUCTOR'S MONITOR SYSTEM
CM MONITOR CAMERA
M-1 CLASSROOM 1 MONITOR
M-3 CLASSROOM 3 MONITOR
— CLASSROOM TV SYSTEM
C DEMONSTRATION CAMERA
R TELEVISION RECEIVER

TV DISTRIBUTION OF MOTION PICTURE IMAGES


16MM. PROJECTOR (SYNCHRONOUS)
MULTIPLEXER
TV CAMERA CHANNEL 4
CHAIN 1
AUDIO-MIXER
16MM. PROJECTOR (SYNCHRONOUS)
MULTIPLEXER
TV CAMERA CHANNEL 13
CHAIN 2
AUDIO-MIXER
RECEIVER A
4
RECEIVER B
13
RECEIVER C
4

THE HOW—Achieving Goals

First, focus the attention of those with whom you work on the *kinds of learning activities* that should be carried on in a modern school. When teachers, administrators, parents, and pupils all agree that these activities are important to a good school program, all will support the steps needed to make the program possible.

Second, do not leave to chance the possibility that school planners may already be familiar with the recommendations given in this brochure. Make certain that their attention is called to these recommendations and that the importance of taking them into consideration in planning the school plant is emphasized.

Third, be sure that the teachers who are to work in the new or remodeled school building are acquainted with the facilities that are to be made available and are given an opportunity to suggest alterations and additions which might make the classroom more suitable for their own teaching purposes. Make it a point to discuss the recommendations in this handbook with them.

Fourth, if you wish to consult a qualified audio-visual education specialist at the time you are carrying on your building program, write the Department of Audio-Visual Instruction of the National Education Association, 1201 Sixteenth Street, N. W., Washington 6, D. C., for a list of persons in each section of the nation who are able to give assistance.

Finally, your own practical experiences can be of great help to all who are planning new school buildings. If you find that certain recommendations of this handbook are not adaptable to your own situation, or if you find that information which would be of value to you has not been included, please send your suggestions to the Department of Audio-Visual Instruction. Share the wealth of your own experience!

APPENDIX

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Names and addresses of some companies manufacturing and/or distributing equipment and facilities for use in college audio-visual centers. The following code is used to indicate the type or types of products of the company:

B — Booking equipment for audio-visual materials
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C — Cameras and related photographic equipment
DR — Disc recorders
FB — Felt and flannel boards
FE — Film editing and laboratory equipment
FP — Film cleaning and repair
LC — Light control materials and equipment
MB — Magnetic board
PE — Projectors and projector equipment
PS — Projection stands
R — Radio and/or television receivers
RP — Record players
S — Projection screens
SE — Storage equipment; cabinets; shipping cases for films, filmstrips, tapes, recordings, etc.
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